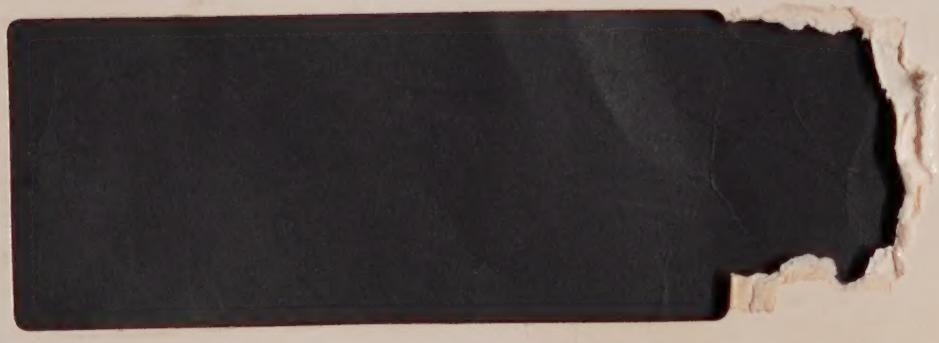
175-0304
TF2473
Roseville



ELDORADO
ELECTRONICS

601 Chalomar Road Concord, California U.S.A. / Telephone: (415) 686-4200

PRELIMINARY

TECHNICAL MANUAL

MODEL 796

TIME INTERVAL COUNTER

ELDORADO ELECTRONICS
601 Chalomar Road
Concord, California 94520
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Please specify both model and serial number in all correspondence concerning Eldorado instruments. Address all inquiries regarding Eldorado instruments to your nearest sales representative or Sales Manager, Eldorado Electronics Company, 601 Chalomar Road, Concord, California 94520.

This Manual is packaged with instrument Serial Number #101.

This instrument is a Model 796.

It contains options

Option	C	☐
Option	D	☐
Option	E	☒
Option	J	☐
Option	N	☐
Option	P2	☐
Option	T	☐
Option	Y1	☐
Option	Y2	☐
Option	Y3	☒
Option	P/A	☐
Option	P/B	☐
Option	P/C	☐
Option	P/D	☐
Option	P/E	☐

Special Modification Number_____.

MODEL 796

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DRAWING LIST

TITLE	DRAWING NO.
Model 796 Block Diagram	D-10-04935
Model 796 Timing Diagram	
Schematic, Input Discriminator	D-11-04814
Schematic, Logic Circuit	D-11-04804
Schematic, 25 MHz DCU	D-11-03968B
Schematic, 25 MHz DCU	D-11-03967C
Schematic, 250 kHz DCU	D-11-03966A
Schematic, Memory Readout	D-11-04000
Schematic, Test Pulser	C-11-04942
Schematic, Option D & E Oven Power Regulator	A-11-04949
Schematic, Coincidence Circuit	B-11-04803
Schematic, Stop Circuit	C-11-04943
Schematic, Add One Circuit	D-11-04948
Schematic, Stabilizer Circuit	D-11-~~04546~~ECII C
Schematic, 80 MHz Multiplier and VHF ÷ 8	D-11-04547B
Schematic, Start Up Oscillator	C-11-03440A
Schematic, Power Supply	D-11-04917
Schematic, Reference Oscillator (STD)	A-11-04979

SECTION 1

INTRODUCTION

1.1 GENERAL

The Model 796 Time Interval Counter provides 1 nanosecond resolution without the customary ±1 count digital error. A flexible input circuit, more accurate and complete than provided by most lower resolution Time Interval Counters, provides unlimited signal conditioning. The trigger level can be set for any voltage from +0.1 volts to +128 volts or -0.1 volt to -128 volts with selection at either a positive or negative slope. The chosen trigger level is almost entirely independent of waveform rise time or of ambient temperature change. Also, markers are provided at the time of the start and stop triggers, for convenient monitoring on an external oscilloscope.

Long term stability is assured by a variety of crystal oscillator options to provide stability commensurate with the number of decades ordered (6 standard, up to 9 optional) or as dictated by the application.

1.1.1 APPLICATIONS

Instrument Calibration - With resolution at least an order of magnitude finer than most comtemporary equipment, the 796 can be used to calibrate the time between pulses from delay generators; the pulse widths of pulse generators; the accuracy of other Time Interval Counters; the accuracy and linearity of oscilloscope sweeps.

Delay Lines - Permits precision adjustment of all types of delay lines. A pulse applied to the input of the delay line starts the Model 796. The delayed output pulse provides the 796 stop signal. The delay is instantly displayed on the 796 visual indicators. The fast recycle rate (to 10 kHz, if the 796 is externally driven) permits fast operator adjustment of the delay.

Cable Length - Measures the electrical length of any cable from 1/2 foot or less to 500,000,000 feet or more - with an accuracy of 1 nanosecond.

Cable Fault Location - Permits location of faults in buried cables to within six inches. A pulse applied to the cable is used as the Start signal to the 796 and the reflection from the fault is used as the Stop signal. The electrical distance to the fault is one half the reading on the 796. If the propagation velocity of the cable is 5 nanoseconds per meter, the total time to the fault and back is 10 nanoseconds per meter or approximately 3 nanoseconds per foot. The Model 796 thus provides a resolution of about 1/3 foot or four inches.

Ranging Measurements - The time required for a radar or laser pulse to go to a target and return is approximately 2.034 nanoseconds per foot of range. The 796 offers a resolution of 1 nanosecond and thus provides resolution of Radar or Laser Range to better than 1/2 foot. With the full capacity of 9 decades installed a distance of 500,000,000 feet could be measured with a resolution and accuracy of approximately 1/2 foot.

Coincidence Detection - The 796 can be used as a "null" detector to determine exact coincidence between two pulses. Special circuitry permits measurement of "negative" time (Stop signal occurring before Start) from about -10 nanoseconds through zero. Accordingly an operator can easily adjust for precise coincidence (zero time between Start and

Stop pulses) by observation of the reading as it progresses from "negative" time through zero to positive time and then to a precise zero. Operator confusion is avoided by presenting negative time as the complement; thus 99 indicates -1; 98 indicates -2 nanoseconds and so on. In addition a minus light provides visual indication of "negative" time and this information is also brought to the digital recorder output.

Nuclear Measurements - The Model 796 permits adjustment of timing to one nanosecond of pulse outputs of photomultiplier tubes; the calibration of cable delays in experimental set ups. In actual experiments the 796 permits digital determination of time-of-flight and digital presentation of pulse coincidence.

Computer Checkout - Offering a wide variety of measurements including, the measurement of pulse widths, the rise and fall time of pulses, the period of sine or pulse waveforms,interconnecting cable delay; the Model 796 provides the ability to check most computer parameters. If provided with the optional Remote Programming all controls except the Input Multipliers can be programmed for automatic checkout. Results can be visually recorded and/or digitally recorded on equipment such as printers or tape punches for a permanent printed record of the system parameters.

Period Measurements - The Model 796 permits single period measurements from 50 nanoseconds to 2 seconds with a resolution of one nanosecond, without the customary ± 1 count gating ambiguity. By converting the period reading to frequency, the Model 796 can be used as a frequency counter. For frequencies less than 100 kHz, resolutions of 1 Hz or better can be achieved. At frequencies to 20 MHz resolution is proportionally reduced to 250 kHz at 20 MHz.

1.2 OPERATION

When making time interval measurements, the operator is interested in the time between the initiation and termination of an event. In most time interval counters, the output of a high accuracy oscillator is gated ON at the beginning of the event and OFF at the end of the event. During the gate ON period, each output cycle of the oscillator is totalized on the readout indicators. The higher the oscillator frequency used, the better is the resolution of the measurement.

Normally, design of a 1 nanosecond time interval counter by standard techniques would require a 1 gigahertz (10^3 MHz) clock generator, a high speed gate, and a 1 gigahertz decimal counting unit. This could be done in the light of today's technology, but, even then, readings from such an instrument would be accurate to only ± 1 nanosecond.

The Model 796 utilizes lower speed circuitry with a special interpolating technique to achieve better accuracy and reliability, in addition to eliminating the normal ± 1 count digital error. This error, normally encountered in other instruments, is not present here. This is due to the phase locking memory in the Start and Stop channels. Each memory effectively causes any measured time interval to be referenced to a common starting point on each of the clock signals, thereby eliminating the usual quantizing error associated with non-phase locked systems.

Referring to Figure 1-1, the Model 796 measurement cycle begins when a signal arrives at the input of the Start channel. Due to the special design of the 10 MHz clock and its combination with a memory element, 100 nanosecond clock signals are produced which are precisely phase locked to the start signal. These signals are totalized in decimal counting units. No. 3 through 9. No information is fed to No. 1 and 2 decimal counting units until receipt of the stop signal.

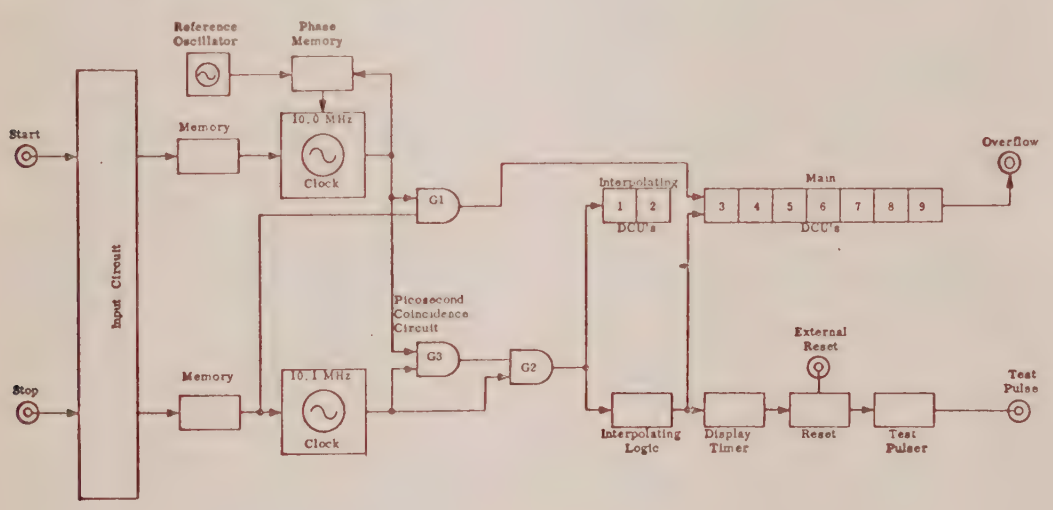


FIGURE 1-1 MODEL 796 SIMPLIFIED BLOCK DIAGRAM

When the stop signal arrives, it inhibits Gate G1, thus turning OFF the 10.0 MHz Start channel clock pulses being totalized in decimal counting units No. 3 through 9. The same stop signal simultaneously phase locks the 10.1 MHz stop channel clock through its input memory circuit. This clock produces square waves with a period of 99 nanoseconds. These pulses are fed through Gate G2 to decimal counting units No. 1 and 2 until the picosecond coincidence circuit G3 senses coincidence between the 10.0 MHz and 10.1 MHz signals. When this happens, picosecond coincidence circuit G3 inhibits Gate G2 and the number of 10.1 MHz clock pulses generated between the stop signal and coincidence are displayed on No. 1 and 2 decimal counting units. The result is that DCU's No. 1 and 2 display the number of 1 nanosecond time intervals, by vernier interpolation, while DCU's No. 3 through 9 display the number of 100 nanosecond time intervals in real time. The reading on the visual display tubes is the total number of one nanosecond time intervals indicated in nanosecond units.

If a stop signal arrives at the same time a 100 nanosecond clock pulse is present, an additional count could be added in error, to the reading in DCU's No. 3 through 9. To compensate for this, a special interpolating logic circuit is included to remove the possibility of any such ambiguity.

Figure 1-2 illustrates the Model 796 frequency vernier interpolation principle where the difference in time between the last counted 10.0 MHz Start channel clock pulse and the last counted 10.1 MHz Stop channel clock pulse is reduced by 1 nanosecond for every cycle of the 10.1 MHz Stop channel clock until coincidence is reached. A direct analogy to this technique is that of the machinist's vernier measuring scale where it is possible to interpolate between graduations on parallel scales to 2 or 3 decimal place accuracy.

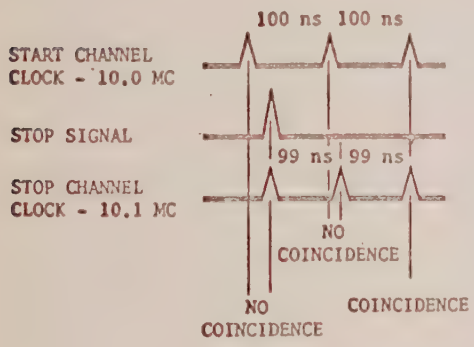


Figure 1-2. Frequency Vernier Interpolation Principle.

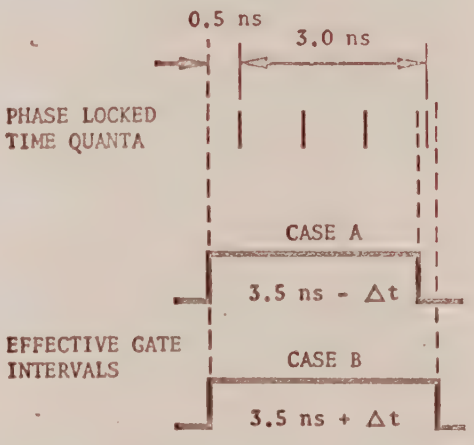


Figure 1-3. No Quantizing Ambiguity.

Referring to Figure 1-3, a discrete time interval may be repetitively counted in Model 796 without any change in the last digit occurring. For instance, a time interval between 3.0 and 3.5 nanoseconds always reads 3.0 nanoseconds and if the time interval increases just beyond the 3.5 nanosecond point, the instrument will always read 4.0 nanoseconds. The reading error of any measurement thus never exceeds 0.5 nanoseconds.

The Model 796 input circuit is as advanced as the remainder of its circuitry. A calibrated trigger level control permits triggering at a precise voltage level which can be continuously varied from 0.1 volt to 1.0 volt. This voltage level can be increased by a multiplier switch, accurate to 2%, in binary steps from X1 through X128 to permit trigger at any level from 0.1 volt to 128 volts.

The dynamic range on any trigger level is a minimum of ten to one. Therefore, input signals from a minimum of 0.1 volt to a maximum of 250 volts can be accommodated providing the power limitation of 0.25 watts is not exceeded.

The binary multiplier steps permit automatic measurement of pulse width to the 50% point (ref. paragraph 1.1.1 - Pulse Width Measurements).

Three modes of operation are provided:

TIM (A-B) - Time Interval Measurements between an input at A to an input at B.

The Start Signal (input A) and the Stop Signal (input B) can be individually adjusted to trigger at any level chosen by the individual trigger level and Multiplied controls.

Individual polarity control switches enable trigger of Start and Stop to occur at any level either plus or minus between plus 0.1 volt to plus 128 volts or -0.1 volt to -128 volts.

Individual slope control switches permits triggering on either the positive going or negative going edge of the signal.

The combination of flexible control permits digital measurement of rise or fall time of an individual pulse or time between leading edges or trailing edges of a pulse train.

Interlock logic is not provided on the TIM function so that measurements down to one nanosecond can be made. In fact, the Stop channel can be triggered before the Start, with a presentation of "negative time" to permit the Model 796 to be used as a null meter for adjustment to a precise zero time.

PER (A) Period Measurement - The time interval between two successive A inputs at the same trigger point and slope.

The A input trigger controls, of voltage, multiplier, polarity and slope control both the Start and Stop levels. Therefore, the Start occurs at exactly the same point of the input waveform as the Stop to assure accurate determination of the time of one input cycle.

Interlock logic is provided in order that a Stop signal not be recognized until the recognition of a Start. This feature is required since Start and Stop are received on a common input (input A). The Interlock logic delays the Stop channels ability to accept an input until 50 nanoseconds after receipt of a Start acceptance. This allows period measurements to be performed from a minimum of 50 nanoseconds to the full range of the instrument with one nanosecond resolution and accuracy.

WIDTH (A) Width Measurement - The time interval between two successive A inputs at the same trigger point but opposite slope.

The input A trigger controls, of voltage, multiplier, polarity and slope control the point of trigger on both Start and Stop. However, the Stop slope polarity is always opposite the chosen Start slope polarity to provide an automatic width measurement at the chosen trigger point.

Interlock logic is again provided since the inputs are received on a single input (A) and digital determination of width is provided from 10 nanoseconds to the full range of the instrument with one nanosecond resolution.

Another feature of the Model 796 is a Test Pulser which produces an output test pulse 30 microseconds after each reset pulse.

SPECIFICATIONS

MODEL 796 TIME INTERVAL COUNTER

FUNCTION:	Digital Determination with 1 ns resolution of time interval, period, pulse width.
GENERAL SPECIFICATIONS:	
Modes:	
TIM	Measure time interval between two events. Start with plus or minus polarity and plus or minus slope and stop with independently selected plus or minus polarity and plus or minus slope.
PER	Measure duration of one input cycle. Start and Stop with same polarity and slope (either plus or minus polarity and plus or minus slope).
WIDTH	Measure duration of one pulse. Start with selected slope and stop with opposite. Start and Stop are the same polarity.
Minimum Time Measurement	
TIM	0 ns
PER	50 ns
WIDTH	20 ns
VISUAL PRESENTATION:	6 decades with options to 9 decades of long life digital display indicators with amber circularly polarized filter plus overflow and minus indicator. Reads in nanoseconds.
RESOLUTION:	1 nanosecond
ACCURACY:	1 ns ± oscillator stability to 10,000 μs; 1.5 ns 10,000 μs to 1 s ± oscillator stability.
OSCILLATOR STABILITY:	
Aging Rate	$+3 \times 10^{-8}$ per day after 30 days operation
With Temperature	In normal laboratory environment of 16° C to 32° C (60° F to 90° F) after 30 minutes of operation, stability is 2×10^{-7} per ° C change of ambient temperature.
	Over entire operating temperature range (0° C to 52° C) total drift will not exceed 20 ppm (0.002%).
INPUT CHARACTERISTICS:	
Input Connectors	Front panel counted BNC
Input Impedance	50 ohms; reflection from 100 ps step less than 10%
Trigger Level	0.1 to 1.0 V continuously variable times multiplier setting.

Multiplier	X1, X2, X4, X8, X16, X32, X64, X128 of trigger level.
Dynamic Range	10:1 minimum on any attenuator position
Maximum Power	0.25 watt continuous or 250V for 1 μs
Rise Time Requirements	None
Minimum Trigger Requirements	
TIM (Time Interval) A-B	0.1V peak - For optimum trigger performance inputs should exceed trigger level by 250 mV peak.
PERIOD (A)	0.1V peak
WIDTH (A)	0.1V plus trigger setting (0.2V peak minimum)
Trigger Stability	
With Temperature	<10 mV change from 0 - 52° C
With Rise Time	<20 mV change from dc to 1 ns
With Pulse Width	Infinite to 20 ns - no change. 1 ns wide pulses increase minimum input requirements to 0.5V peak.
Maximum Voltage	10V times multiplier setting up to 250V

DIGITAL RECORDER OUTPUT:

Data Word	1-2-4-8 positive true, negative level BCD; for each data digit "0" = -10V nominal, "1" = -0.3V nominal; 6.8k internal resistance.
Print Command	Negative going step at end of count cycle from 0V to -12V nominal with fall time <1 μs; 1k ohm maximum internal resistance. Return to 0V remains longer than 50 μs. Duration of print command is equal to the display time, 100 ms minimum to 5 s maximum on EXT. RESET. Minimum length can be as short as 9 μs.
Reset Inhibit	Requires an inhibit level of 0V if supplied from <1k ohms resistance to +30V at up to 30 k ohms resistance.
Inhibit Release	Requires a release level of 0V to -6V if from >20k ohm resistance or -6V to -30V from any source impedance.
Overflow and Minus Indication	One data digit where 0 represents no overflow and no minus; 1 represents overflow and 2 indicates minus (overflow and minus cannot occur simultaneously since maximum negative (minus) reading cannot exceed approximately 20 ns). Data is presented in same code and same levels as Data Word.
Compatibility	Clary 7000, with option II logic and standard print command; CMC 410A, with logic option 4a; Franklin 1200 with reverse logic; HP 562A with option 22 logic boards, 1 option 30 and 1 option 31 BCD input cable; HP 5050A with option 01 installed and with 2 each option 32 input cables; Monroe 10-40-M1-0-K.

Printing Format	Standard, ZOOOXXXXXX; Y1, ZOOXXXXXXX; Y2, ZOXXXXXXXX; Y3, ZXXXXXXXXX. X = Data, O = wired to print 0, Z = Overflow or minus reading. Overflow prints 1, Minus prints 2.
FRONT PANEL CONTROLS:	
Power Off - Direct - Store	Rotary switch controls instrument power and chooses "store" or "follow" operation.
Reset	Pushbutton
Null	Screwdriver adjustment for zero setting or cable compensation.
Display	Single turn potentiometer with switch position at full cw, varies display time from approximately 0.1 s at the ccw position to 5 s at full cw, and until EXT RESET in cw switched position.
Mode	Selects TIM (A-B), PER (A), or WIDTH (A) by 3 position rotary switch.
Start (A) Input Trigger Level Control	Single turn potentiometer varying the trigger point from 0.1V through 1V on times 1 position of the Multiplier control.
Start (A) Input Multiplier Control	Multiples trigger level by X1, X2, X4, X8, X16 X32, X64 and X128. Accuracy ±2%
Start (A) Slope Switch	Selects + or - slope for start.
Start (A) Polarity Switch	Selects + or - polarity for start.
Stop (B) Input Trigger Level Control	Same as Start Input Trigger Level Control.
Stop (B) Input Multiplier	Same as Start Input Attenuator.
Stop (B) Slope Switch	Same as Start Slope Switch.
Stop (B) Polarity Switch	Same as Start Polarity Switch.
REAR PANEL:	
CONTROLS AND CONNECTORS	
INT. MON. - EXT. IN.	Recessed slide switch permits monitor of internal 1 MHz crystal (1V rms from 500 ohms) on INT. position or accepts external 1 MHz standard supplying 1V rms into 10k ohm in EXT. position.
EXT. reset	BNC type UG 1094 accepts negative pulse 4-10V into 1k ohm, 1 μs minimum width. Maximum rep rate 10 kHz.
Test Pulse	BNC type UG 1094 supplies test pulse to E/E 421 or for driving customer circuitry. Pulse is +15V minimum into 50 ohms, 8 ns nominal width, <2 ns rise. Occurs 30 μs nominal after end of reset.

Start Enable	Recessed slide switch chooses INT or EXT signal. External signal applied to BNC type UG 1094. Signal required is -3 minimum to -10V maximum, 1 μs, minimum width into 10k ohms.
Trigger Monitor	BNC type UG 1094 supplies pulses at start and stop trigger points. Pulse is >.5V with <5 ns rise and >10 ns wide into 50 ohms.
Data Output	Amphenol 57-40500 50 pin connector to external data handling device. Mating connector not furnished.
117V - 234V	Recessed slide switch chooses 115 or 230V operation.

PHYSICAL SPECIFICATIONS

Size	Nominal 5-1/4" high by 20-5/8" deep x 16-3/4" wide. With rack mounting ears attached, the instrument shall conform to RETMA Std. SE-102 providing for a vertical height of 5-7/32" ± 1/64" and a horizontal mounting width of 19" ± 1/64".
Weight	40 lbs net; 58 lbs. shipping
Power Requirements	115V ±10%, 48-62 Hz, 140 watts. Permanently attached 6' power cord terminating in standard 3 prong plug.

ACCESSORY ITEMS

2 each instruction manuals
1 each 3-2 ac line adapter
2 each extender boards
2 each rack ears

PAINT SPECIFICATIONS

Front and Rear Panels	Light gray color 26492 per FED STD 595 non-textured.
Silkscreen	Blue-black, color no. 26042, per FED STD 595.
Front and Rear Bezels	Blue-gray color per FED STD 595, color no. 26321, textured finish.
Left and Right Side Gussets	Lt. gray color per FED STD 595, color no. 26492, textured finish.
Top and Bottom Covers	Lt. gray color per FED STD 595, color no. 26492, textured finish.
Rack Ears	Blue-gray color per FED STD 595, color no. 26321.

TABLE OF OPTIONS

Option C Internal crystal oscillator, provides oscillator stability of:

Short Term: 5×10^{-8} per day (average)

Long Term (aging rate): 3×10^{-7} per week after 24 hours.

Temperature: $\pm 5 \times 10^{-9}$ per ° C (0° C to 52° C)

Option D Internal crystal oscillator, provides oscillator stability of:

Short Term: $\pm 5 \times 10^{-10}$ peak to peak per 10 s, measured over a 60 s period of 5 consecutive readings, at constant temperature.

Long Term: (aging rate) subject to the following stabilization times:

(a) 3×10^{-9}/day
(b) 9×10^{-8}/month

Time Off Power	Days to Restabilize
Up to 7 days	3 maximum
8 through 30 days	4 to 14 maximum
30 days or more	15 to 30 maximum

Ambient: 2×10^{-10}/°C maximum from -20° C to +55° C

Warm Up and Stabilization Time: From +25° C ambient to final stabilized frequency:

(a) Within 1.5×10^{-7} in 30 minutes
(b) Within 2×10^{-8} in 60 minutes

Option E Internal crystal oscillator, provides oscillator stability of:

Short Term: $\pm 5 \times 10^{-10}$ peak to peak per 10 s, measured over a 60 s period of 5 consecutive readings, at constant temperature.

Long Term: (aging rate) subject to the following stabilization times:

(a) 1×10^{-9}/day
(b) 3×10^{-8}/month

Time Off Power	Days to Restabilize
Up to 7 days	3 maximum
8 through 30 days	4 to 14 maximum
30 days or more	15 to 30 maximum

Ambient: 2×10^{-10}/° C maximum from -20° C to +55° C

Warm Up and Stabilization Time: From +25° C ambient to final stabilized frequency:

(a) Within 1.5×10^{-7} in 30 minutes
(b) Within 2×10^{-8} in 60 minutes

Option J Remote Programming of MODE, POLARITY, and SLOPE switches. Provides remote trigger level control with remote 50 ohm potentiometer. Option J adds fourth position to MODE switch labeled REMOTE and adds rear mounted Amphenol 57-40240 24 pin connector labeled REMOTE CONTROL. Mating connector Amphenol 57-30240 is furnished with option.

Option N — Provide for input connectors on rear panel only.

Option P2 — Provides compatibility for all printers previously listed and adds the Beckman, Model 1453.

P2 changes the print command so that the return to zero between measurements is equal to or greater than 15 ms. With option P2 installed, the maximum recycle rate of the Model 796 on external or internal reset is limited to 60 Hz rather than 10 kHz.

Option T — 115/234 Vac ±10%, 50-400 Hz operation.

Option Y — Expands display to 7 digits (Y1), 8 digits (Y2), or 9 digits (Y3) with overflow and minus indicators for visual display and digital recorder output.

PRINTER CABLE OPTIONS:

P/A — Adapter cable for Beckman, Model 1453 (applicable Option P2 only).

P/B — Adapter cable for Clary, Model 7000, Franklin, Model 1200, or Monroe, Model 10-40.

P/C — Adapter cable for CMC, Model 410A.

P/D — Adapter cable for H-P, Model 562A.

P/E — Adapter cable for H-P, Model 5050A.

SECTION 2

INSTALLATION AND OPERATION

2.1 GENERAL

This section describes the Installation and Operation of the Model 796 Time Interval Counter, and is in three parts; Incoming Inspection, Installation, and Operation.

2.2 INCOMING INSPECTION

This instrument must be inspected for damage incurred during shipment, and an inventory of accessories as listed on the packing slip be taken (see Warranty page). If instrument has been damaged, notify carrier immediately, so that inspection can be made and a claim filed.

2.2.1 Incoming Confidence Check (to be performed by competent technical personal).

The Model 796 Time Interval Counter, when shipped was in ferfect working order and calibrated to meet all specifications. Certain readjustments may be required after the instrument has been shipped.

If a Model 420 or Model 421 Calibrator is available, the instrument should be checked and readjusted if necessary, using Procedure A. If a calibrator is not available, Procedure B may be used to check and adjust the instrument to within 1 ns.

Procedure A

1. Connect power cord to AC mains and turn instrument ON. Allow a warm up time of 1/2 to 1 hour.
2. Referring to Figure 2-1, make the necessary interconnections and place the controls and switches as noted.
3. Push the manual Reset on the Model 796 to activate the calibrator, and allow to run for 5 more minutes.
4. Check the instrument over the full range of the calibrator, (0 to 15 ns) with and without the 1/3 ns delay inserted. The 1/3 ns delay should not change the reading.
5. If the instrument reads correctly, no adjustment is required.
6. If the instrument requires readjustment, follow steps 7 through 10.
7. Set the calibrator for a 15 ns delay, and adjust the NULL potentiometer for a reading of 15 ns.
8. Set the calibrator for a 5 ns delay, and adjust the STOP potentiometer for a reading of 5 ns, if required (refer to chassis and cabling diagram on inside top cover).
9. Repeat Step 7 using delays of 11 thru 15 ns, with and without the 1/3 ns delay inserted.
10. Repeat Step 6 using delays of 1 thru 5 ns, with and without the 1/3 delay inserted.

Procedure B

1. Connect power cord to AC mains and turn instrument ON. Allow a warm up time of 1/2 to 1 hour.
2. Check 1 MHz oscillator frequency against standard and readjust if necessary.
3. Connect a coaxial cable terminated at both ends with BNC connectors from the 1 MHz oscillator BNC connector (rear panel) to the Input A BNC connector.
4. Place MODE switch in PERiod, Input A Multiplier in X1, Trigger Level at minimum (full cw) Slope and Polarity switches at plus (+).
5. Allow instrument to run for 5 minutes.
6. Adjust the NULL potentiometer for a display of 1000 -1+0 count, if necessary. If the instrument reads between 999 and 1000 DO NOT ADJUST.

2.3 INSTALLATION

The Model 796 is shipped ready for bench mounting, and is equipped with a self locking, elevating bail for convenient bench viewing. The instrument is easily converted to a rack mount configuration.

The rack mounting procedure is as follows:

1. Remove elevating bail and rubber feet from bottom cover by removing the slotted head screws in the depressions on the rubber feet.
2. Remove rack ears from accessory package.
3. Remove nylon screws from side panels.
4. Fasten rack ears in position with mounting screws supplied.
5. Remove blank panel in rack.
6. Install instrument in rack using hardware previously removed.
7. Install cable connections as detailed in Paragraph 2.3.1.

2.3.1 INSTRUMENT CABLING

This instrument should be connected to AC power as soon as possible to begin oscillator oven cycling. The rear panel 117 Vac/234Vac switch should be set to the appropriate position before connection.

The Model 796 Time Interval Counter is shipped ready for use except for signal input cabling.

1. The input signals are supplied to the instrument through the front panel BNC connectors (Input A and Input B).
2. Data Output: This instrument may be used with a variety of mechanical printers. The binary-coded-decimal output signals are available at the rear panel DATA OUTPUT connector J1 (see Table 2-2 for connector type and pin allocations). Printer cables are normally supplied with the printer. A variety of adapter cable options (see Table of Options, Section 1) are available to supply the proper interface connections with the following printers:
    a. Beckman Model 1453 with 12 digits (with Options P2 and P/A only).

b. Clary Model 7000, 12 columns with Option II logic and standard print command.

c. CMC, Model 410A, 12 columns with Option 4a logic.

d. Franklin Model 1200-12, with reverse logic.

e. H-P Model 562A with 12 Option 22 logic boards.

f. H-P Model 5050A with Option 01.

g. Monroe Model 10-40-M1-0-K, 12 columns capacity.

3. Remote Control (Option J only): Option J provides for remote programming of MODE, POLARITY, and SLOPE switches and provides for remote trigger level control for each channel. Interface connections are made through the rear panel REMOTE CONTROL connector J2 (see Table 2-3 for connector type and pin allocations).

4. External Reset: Rear panel BNC connector. Allows external reset of the instrument. Requires a 4V to 10V negative pulse of 1 microsecond minimum duration for reset. DISPLAY TIME control must be in the EXTernal RESET position.

5. Test Pulse: Rear panel BNC connector. Supplies test pulse to Eldorado Electronics Model 421 Calibrator or to drive customer circuitry. The pulse is +15V minimum into 50 ohms, 8 nanoseconds nominal width with <2 nanoseconds risetime. Occurs 30 microseconds after reset.

6. Start Enable: Rear panel BNC connector. Requires a -3V to -6V pulse of 1 microsecond minimum duration into 10k ohms for external START ENABLE. INTernal/EXTernal switch must be in EXTernal position.

7. Trigger Monitor: Rear panel BNC connector. Supplies pulses at Start and Stop trigger points to allow oscilloscope monitoring. Supplies pulses of +0.5V, of 5 nanoseconds duration into 50 ohms.

8. 1 MHz Oscillator: Rear panel BNC connector. For use with an external 1 MHz standard or to monitor the internal 1 MHz oscillator. External standard must supply 1V rms into 1k ohms. The INTernal MONitor/EXTernal INput switch must be placed in the appropriate position.

2.4 OPERATION

Operation of the Model 796 Time Interval Counter after initial installation, is by front panel switches and controls, or when the instrument is equipped with Option J, by Remote Control (see Figure 2-1 for front and rear panel nomenclature).

Complete descriptions of each functional control are supplied in Table 2-1.

TABLE 2-1

MODEL 796 TIME INTERVAL COUNTER

OPERATING CONTROLS

CONTROL	FUNCTION
Reset Switch	Manual reset pushbutton. Resets all circuits to zero state. Display returns to zero (000, 000).
Null Adjust	Screwdriver control for zero setting or cable compensation.
Display Mode Switch (3 positions)	
PWR OFF	Places instrument in off condition. Oscillator ovens remain on.
Direct	Display changes during each count cycle.
Stored	Display changes only when quantity measured changes, and then only those digits directly affected.
Input A Trigger Level	
Multiplier	Eight position input level attenuator. Divides Input A by 1, 2, 4, 8, 16, 32, 64, or 128.
Voltage Control	Continuously adjustable control. Adjusts Input A trigger level from 0.1V to 1.0V multiplied by the Input A Trigger Level Multiplier switch position.
Input A Polarity Switch +/-	Selects triggering on either a positive or negative excursion for Input A.
Input A Slope Switch +/-	Selects triggering on either a positive or negative slope for Input A.
Input B Polarity Switch +/-	Same function as Input A Polarity for Input B.
Input B Slope Switch	Same function as Input A Slope for Input B.
Input B Trigger Level	
Voltage Control	Same function as Input A Trigger Level Voltage Control for Input B.

Multiplier

Same function as Input A Trigger Level Multiplier for Input B.

Display Time

Controls display time of instrument. Allows variable display times of from 0.10 seconds to 5 seconds or if in the EXTernal RESET position, until externally or manually reset.

Mode Switch (3 positions)

TIM (A-B)

Allows time interval measurements between an input at A and an input at B.

The combination of flexible controls permits digital measurement of rise or fall time of an individual pulse, or time between leading edges and trailing edges of a pulse train.

Interlock logic is not provided in the TIM mode to allow measurements down to one nanosecond. In fact, the stop channel (Input B) can be triggered before the start channel (Input A), allowing a presentation of "Negative Time", thus the Model 796 can be used as a null meter for adjustment to a precise zero time.

Per (A)

Period Measurement - Allows time measurement between two successive inputs to channel A, at the same trigger point and slope.

Interlock logic is provided in order that a stop signal not be recognized before a start signal. This feature is required because both the start and stop inputs are received on a common input (Input A). The interlock logic delays the stop channels ability to accept an input until fifty nanoseconds after receipt of a start input. This allows period measurements to be performed from a minimum of fifty nanoseconds to the full range of the instrument with one nanosecond resolution and accuracy.

Width (A)

Pulse Width Measurement - Allows measurement of pulse width or the time interval between two successive inputs to channel A.

Interlock logic is again provided, although the stop channel delay is only ten nanoseconds. This allows digital determination of pulse widths of from ten nanoseconds to the full range of the instrument with one nanosecond resolution and accuracy.

TABLE 2-2

DATA OUTPUT CONNECTOR J1 WIRING

PIN #	FUNCTION	PIN #	FUNCTION
1	10^0_0 1 bit	26	10^0_0 4 bit
2	10^0_0 2 bit	27	10^1_0 8 bit
3	10^1_1 1 bit	28	10^1_1 4 bit
4	10^1_1 2 bit	29	10^2_1 8 bit
5	10^2_2 1 bit	30	10^2_2 4 bit
6	10^2_3 2 bit	31	10^3_2 8 bit
7	10^3_3 1 bit	32	10^3_3 4 bit
8	10^4_3 2 bit	33	10^4_3 8 bit
9	10^4_4 1 bit	34	10^4_4 4 bit
10	10^5_4 2 bit	35	10^5_4 8 bit
11	10^5_5 1 bit	36	10^5_5 4 bit
12	10^6_5 2 bit	37	10^6_5 8 bit
13	10^6_6 1 bit	38	10^6_6 4 bit
14	10^7_6 2 bit	39	10^7_6 8 bit
15	10^7_7 1 bit	40	10^7_7 4 bit
16	10^8_7 2 bit	41	10^8_7 8 bit
17	10^8_8 1 bit	42	10^8_8 4 bit
18	10^8 2 bit	43	10^8 8 bit
19	Overflow	44	-12Vdc
20	Negative count	45	-12Vdc
21	Reset	46	-6Vdc
22	Inhibit	47	-30 Vdc
23	+6 Vdc	48	- Print Command
24	- Ref (-9V)	49	NC
25	Ground	50	Ground

NOTES:

1. 10^0 is the least significant digit and appears as the digit farthest to the right.
2. Pin 24 (-9 volt reference) is from a resistor network consisting of 390 ohms in series with -12 volts with 1.8k ohms to ground.
3. Negative print command is a negative step from nominal 0 to -12Vdc at end of count cycle. Fall time is approximately 1 μs. The duration depends on display time and ranges from 100 ms minimum to 10 seconds maximum. Source impedance is approximately 1k ohms.
4. Reset is positive pulse from -6V to +6V 50 μs wide. Internal impedance nominal 50 ohms.
5. Inhibit accepted is 0V if supplied from <1k ohms resistance, to 30V at up to 30k ohms resistance. For non-inhibit reset, requires release level of 0V to -6V if from >20k ohms resistance, or -6V to -30V from any source impedance.
6. Output connector is Amphenol jack 57-40500. Mating connector is Amphenol 57-30500.
7. Unused digits wired to Print Zero.

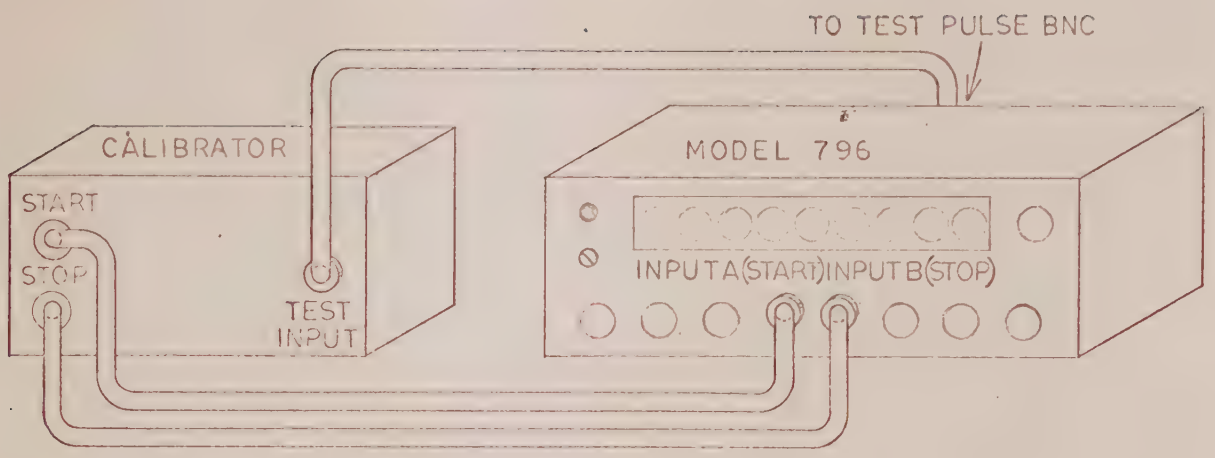
TABLE 2-3

REMOTE CONTROL CONNECTOR J2 WIRING

PIN #	FUNCTION	PIN #	FUNCTION
1	TIM Mode	13	Ground
2	Period Mode	14	Stop Trigger Level Shield Ground
3	Width Mode	15	Stop Trigger Level Return
4	Stop + Slope	16	Stop Trigger Level
5	Stop - Slope	17	+6 Vdc
6	Start + Slope } Period Mode	18	-6 Vdc
7	Start - Slope } Period Mode	19	NC
8	Start + Slope } Width & TIM Mode	20	NC
9	Start - Slope } Width & TIM Mode	21	NC
10	Start Trigger Level	22	NC
11	Start Trigger Level Return	23	NC
12	Start Trigger Level Shield Ground	24	NC

NOTES:

1. Connector is Amphenol 57-40240, requires mating connector type 57-30240.



MODEL 796
SWITCH
POSITIONS

INPUT MULTIPLIER (A&B)	X4
TRIGGER LEVEL (A&B)	0.2
SLOPE & POLARITY (A&B)	+
DISPLAY TIME	MIN. (FULL CCW)
DISPLAY MODE	DIRECT
MODE	TIM

ACCESSORIES
REQUIRED

5 FEET RG 58/U TERMINATED EACH END W/ UG 88-/U CONN.

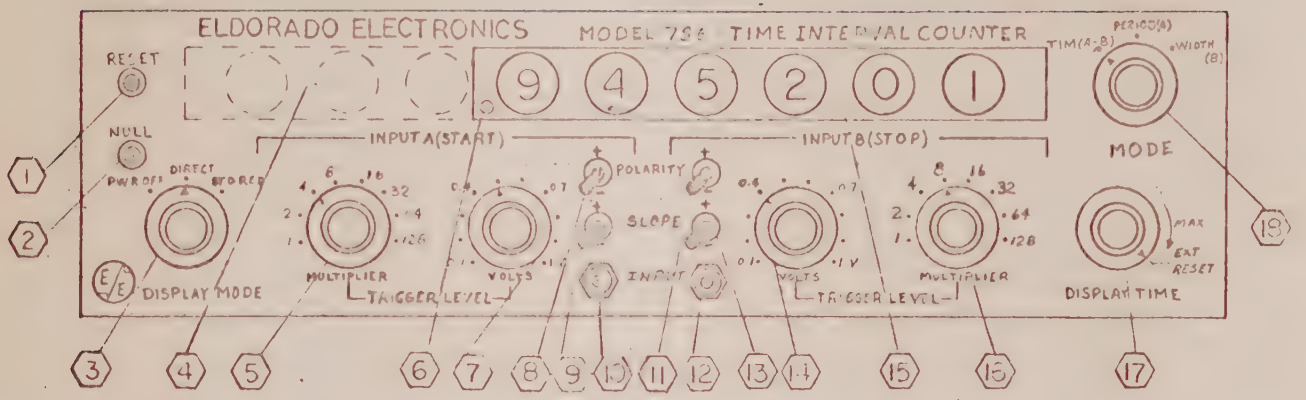
MODEL 420 ONLY- 2ea GR TO BNC ADAPTERS

NOTE:

DO NOT CONNECT MODEL 420 DC POWER CABLE TO MODEL 796

MODEL 420 TO BE IN VARIABLE DELAY MODE.

FIGURE 2-1: PROCEDURE A SETUP



1 Manual Reset Button
2 Null Adjust
3 Display Mode Switch
4 9 Digit Display Indicators
5 Input A Trigger Level Multiplier
6 Overflow Lamp
7 Input A Trigger Level Adjust
8 Input A Polarity Switch
9 Input A Slope Switch
10 Input A Connector
11 Input B Polarity Switch
12 Input B Connector
13 Input B Slope Switch
14 Input B Trigger Level Adjust
15 Display Indicators
16 Input B Trigger Level Multiplier
17 Display Time Control
18 Mode Switch
19 Test Pulse Output
20 External Reset Input
21 INT/EXT Start Enable Switch
22 Start Enable Input
23 INT. EXT Oscillator Switch
24 MON/IN Oscillator Connector
25 Trigger Monitor Output
26 Remote Control 36 Pin Connector (Option J only)
27 Data Output Connector
28 Line Fuse
29 117/234 Vac Switch
30 Power Cord
31 Air Filter

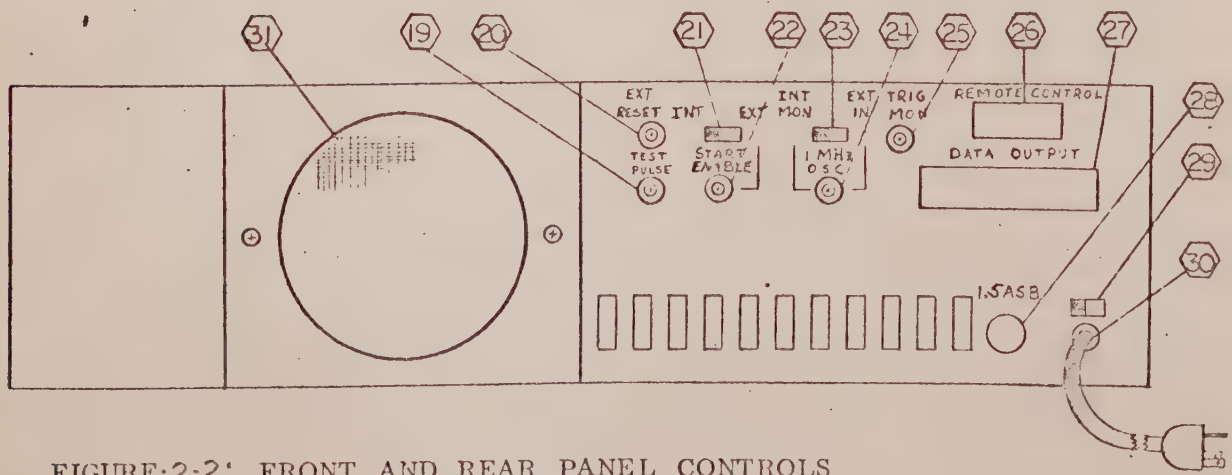
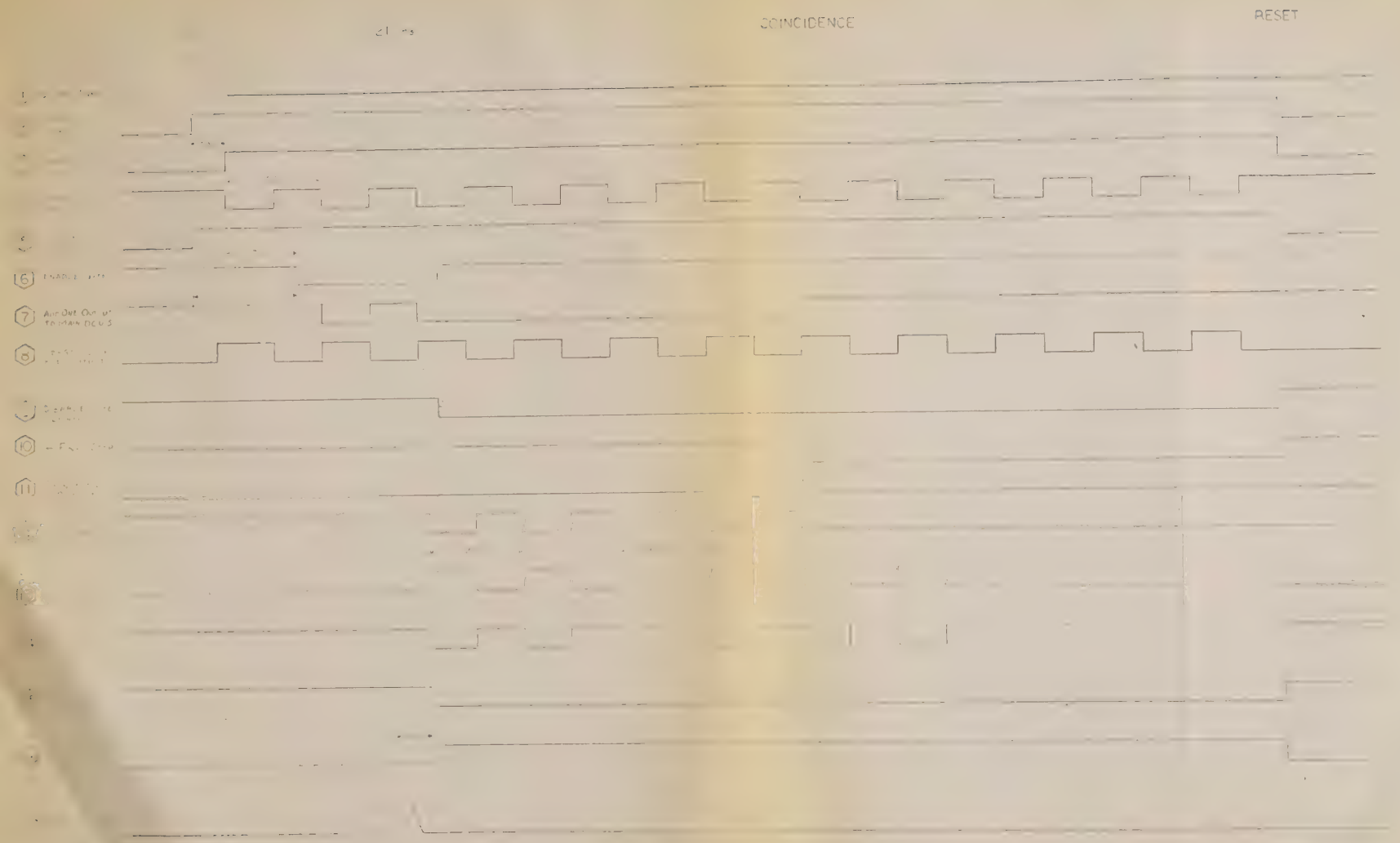


FIGURE:2-2: FRONT AND REAR PANEL CONTROLS

SCHEMATICS



MODEL 796
TIMING DIAGRAM

+30V. INT. EXT. START ENABLE +6V. (6)
R15 10K
R14 68K
R18 120K
R19 120K
R20 6.8K
R21 3.3 K
CR2
CR3
+30V.
+6V.
Q4
Q5
C7 680pf
C8 680pf
R17 4.7K
R23 4.7K
R16 680
R24 680
(34)
-6V.
+6V.
R5 5.6K
R6 1.5K
+30V.
R1 5.6K
Q2
Q3
CR1
C2 270pf
R8 3.9K
R12 3.9K
C5 .001
R13 1K
R7 1.8K
Q1
START ENABLE (13)
0 -3
R4 3.9K
R2 10K
C1 .01
R3 3.3K
-30V.
R9 1K
R11 1K
R10 3.3K
C3 .00
-30V.
C6 330pf
MANUAL RESET (FRONT PANEL)
(35)
R28 10
C9 .1
R27 10K
+6V.
+30V.
+6V.
R42 27
CR6
R41 27K
Q11
C15 .001
Q13 2N3646
Q12
C12 .1
R36 4.2K
R37 4.2K
R38 1.2K
(24)
R26 2.2K
R27 10K
Q6
Q7
CR4
C13 .001
R35 10K
CR7
R25 1K
R30 10K
C10 .001
(29) +RESET 50μSec. +6 -6
R43 360
R66 10K
CR13
C20 270pf
(8) CARRY (FROM LAST DCU)
R31 820
R32 1K
R34 10K
C11 .001
CR5
Q8 2N3646
Q9
Q10 2N3646
R39 2.7K
C14 330pf
R40 47K
-30V.
CR8
R44 2.2K ½W
R45 10K
(2) -RESET 0 -12
-12V.
+12V.
R71 68K
R72 68K
Q22
Q23
R67 6.8K
R68 3.9K
R69 1K
C18 270pf
C19 270pf
R70 6.8K
R73 6.8K
R74
R75 4.7K
(9)
R76 6.8K
R80 3.9K
R79 27K
R81 27K
-12V.
+12V.
R82 2.2K
R83 22K
R84 22K
R85 100
Q26
R90 47K
R91 22K
(18)
+30V.
(11) OVERFLOW
R89 5.6K
Q24
Q25
R88 3.3K
Q27 2N3646
R77 6.8K
R78 1K
R86 6.8K
R87 1K
-12V.

-12V. R46 390 R47 1.2K (10) -9V. (REF.)

Q14
R22 5.6K
R51 100
(12) PRINT COMMAND 0 -12
R52 1K
-12V.
C16 .001
Q15
R53 5.6K
R48 5.6K
R49 10K
R54 1.5K
(22)
Q16 2N3646
STORE 1
DIRECT
PWR. OFF
PIN 18
R50 100K
CR9
-30 V.
-12V.
+6V.
5M
+30V.
DISPLAY (FRONT PANEL)
EXT. RESET
PIN 24
R55 3.3K
R56 3.3K
(15)
+6V.
R61 100K
R62 12K
CR11
Q17 2N3646
Q19
CR12
Q20 TIS43
Q21 2N3646
R63 560
(20)
PRINTER INHIBIT (16) R57 5.6K
R59 56K
CR10
R64 560
MINUS FINAL STOP (14) R58 3.9K
Q18 2N3646
C17 3μf 12V.
R65 10
R60 33K
-30V.
-6V

(4) (19) (1) +12V (3) -12V
(21) -6V (23) +6V (25) -30V (27) +30V

NOTE:
1. UNLESS OTHERWISE SPECIFIED:
a. [illegible] ARE 2N6267
b. [illegible] ARE 2N3702

ITEM	QUAN.	PART NO. OR MAT'L	REV.				
MATL. ENGR.							
DRAWN	EGR 1966	DATE	ECR	DATE	ECR	DATE	
STAFF	3/4/68						
TOLERANCES UNLESS OTHERWISE SPECIFIED: ELECTRONIC ALL DECIMALS ± ALL FRACTIONS ±	MATL. SPEC. ALL TRANSISTORS ALL DIODES	MECHANICAL .00 = ± .005 .000 = ± .000 DIMENSIONS ARE IN INCHES KEEP FREE FROM SCRATCHES, BURRS AND TOOL MARKS	WORLD DIA. ± .005 ANGLES ± 1°				
SCALE							
DRW. BY	R.J.W.						
DATE	8-24-67	TITLE	LOGIC				
DATE	1-12-67	MODEL	796	DRW. NO.	D-11-C48C-1	REV.	

ELDORADO ELECTRONICS

ZONE	SYM	REVISION	ECO	BY	DATE	CHKD
	B	ADDED R52				
	A	INITIAL RELEASE				

INPUT (7)

C4 33 PF
C3 33 PF
CR2
CR5
CR1
CR6
CR3
R3 18K
Q1
Q2
R11 18K
CR4
C6 15 PF
C5 15 PF
R10 4.7K
R4 4.7K
R5 510Ω
R8 5K Ω
R2 10K
R1 68K
R7 68K
R6 10K
RESET TO 9
+12V +12V R

C7 27 PF
C8 27 PF
CR14
CR10
CR13
CR11
R22 18K
Q4
Q3
R19 18K
CR12
CR9
C9 22 PF
C10 22 PF
R18 5.6K
R24 5.6K
R20 680Ω
R21 680Ω
R23 68K
R15 68K
R17 10K
R16 10K

C11 27 PF
C12 27 PF
CR21
CR18
CR20
CR19
R35 1.2K
Q6
Q5
R31 1.2K
CR17
C13 39 PF
C14 39 PF
CR23
R30 6.8K
R37 6.8K
R39 820Ω
R33 820Ω
R34 270Ω
R36 68K
R27 68K
R29 10K
R28 10K

CR28
CR24
CR25
CR26
C15 27 PF
R47 18K
Q8
Q7
R53 1K
R52 10K
C17 39 PF
R48 4.7K
R44 270Ω
R46 10K
R45 68K
R40 68K
R41 10K
-12V +12V
R51 1K
Q9
(5) OUTPUT
CR30
CR31
(6) NINE OUT

R6 270Ω
R9 820Ω
CR7
CR8
Q10
(S) 1
R13 5.6Ω
R26 270Ω
CR32
CR15
CR16
R14 1K
R32 1K
(R) 1
(N) 2
(F) 2
(L) 4
R39 270Ω
R34 270Ω
R50 270Ω
(M) 4
(J) 8
(K) 8
C18 39 PF

(1) +12V
C1 .1μF 250V
C19 .1μF 250V
(3)
L1
C2 .1μF 250V
C20 .1μF 250V
(4)(17)
-12V
SEE NOTE 4

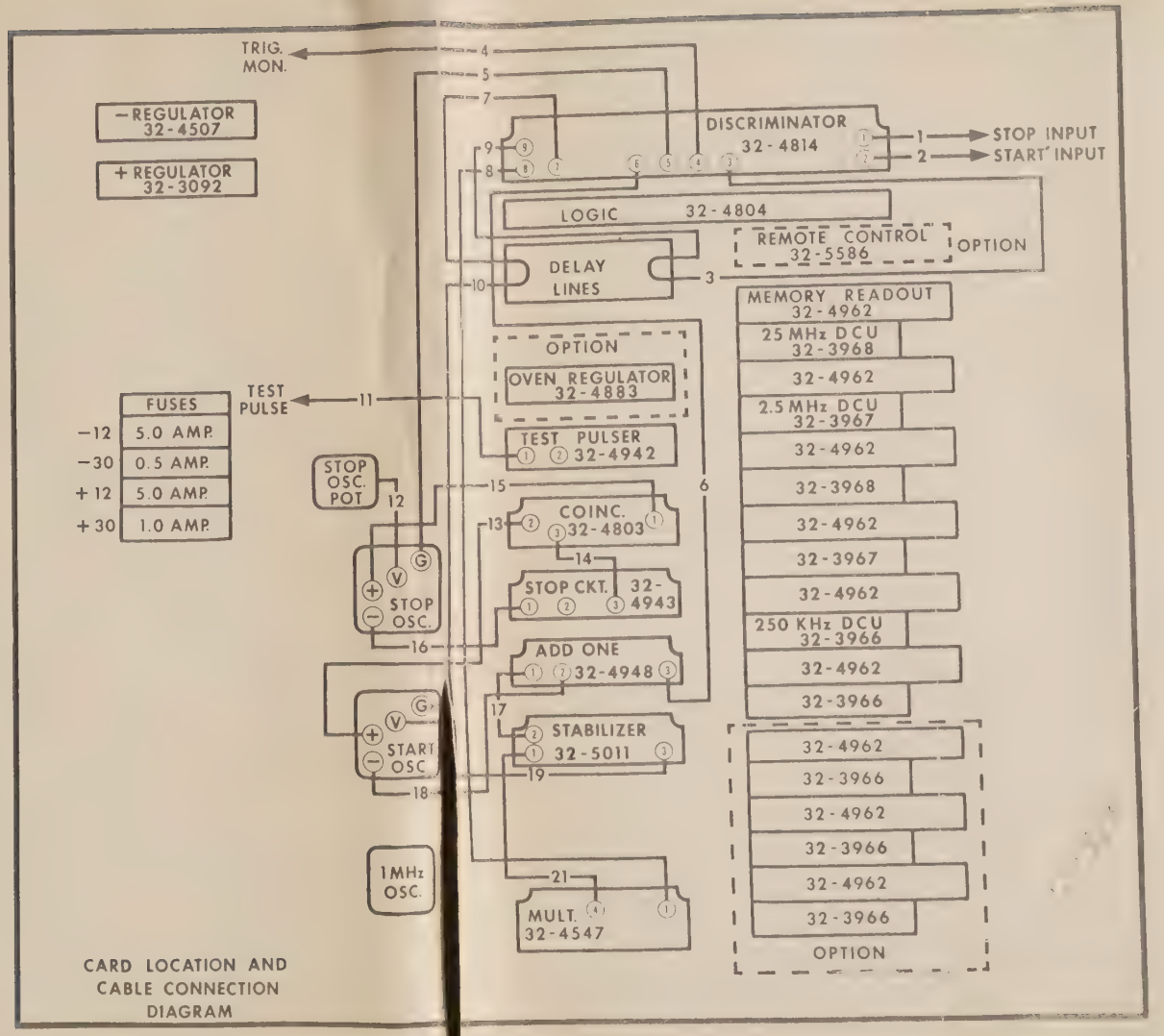
(2) RESET (R)

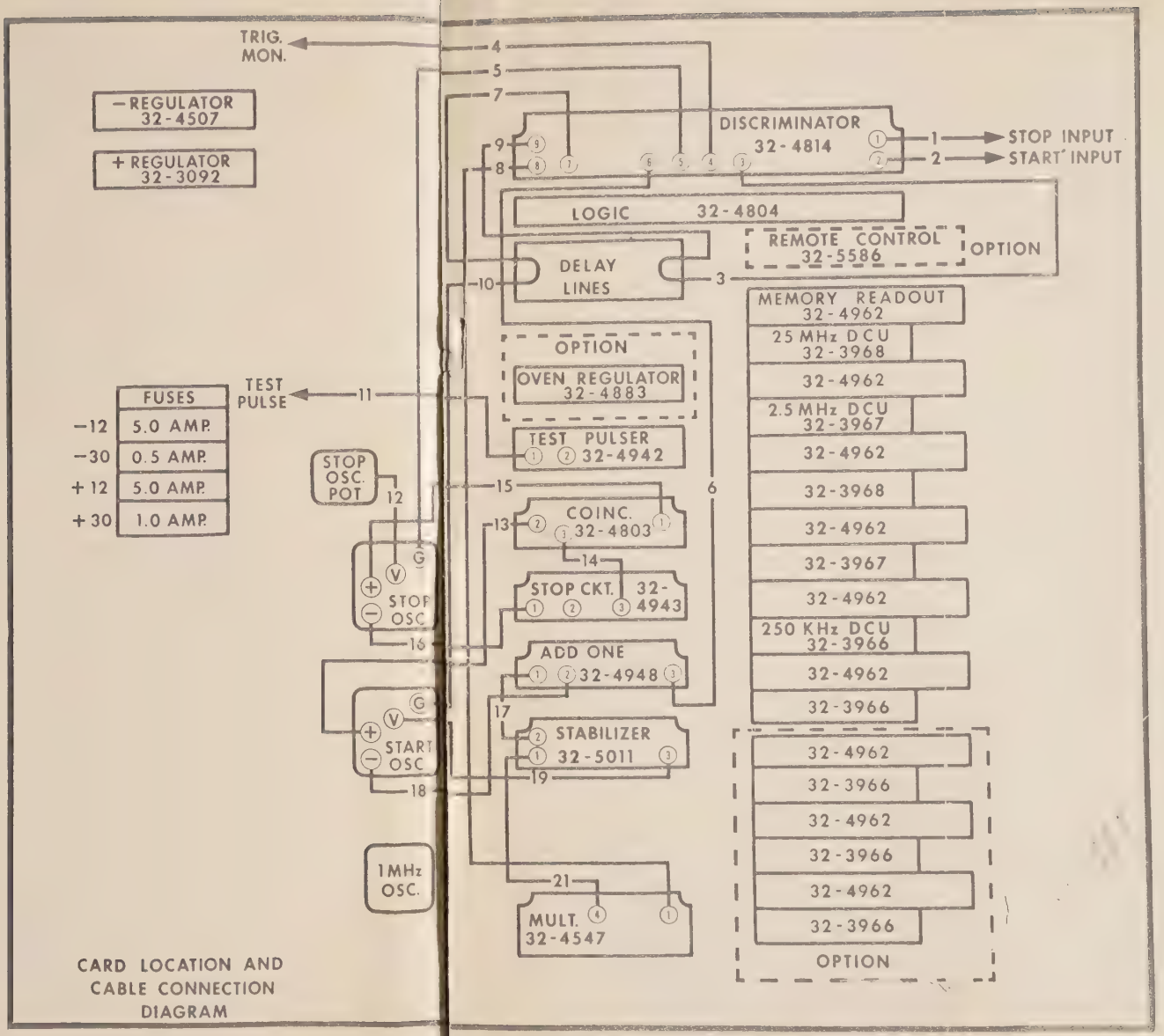
(16) RESET TO 9

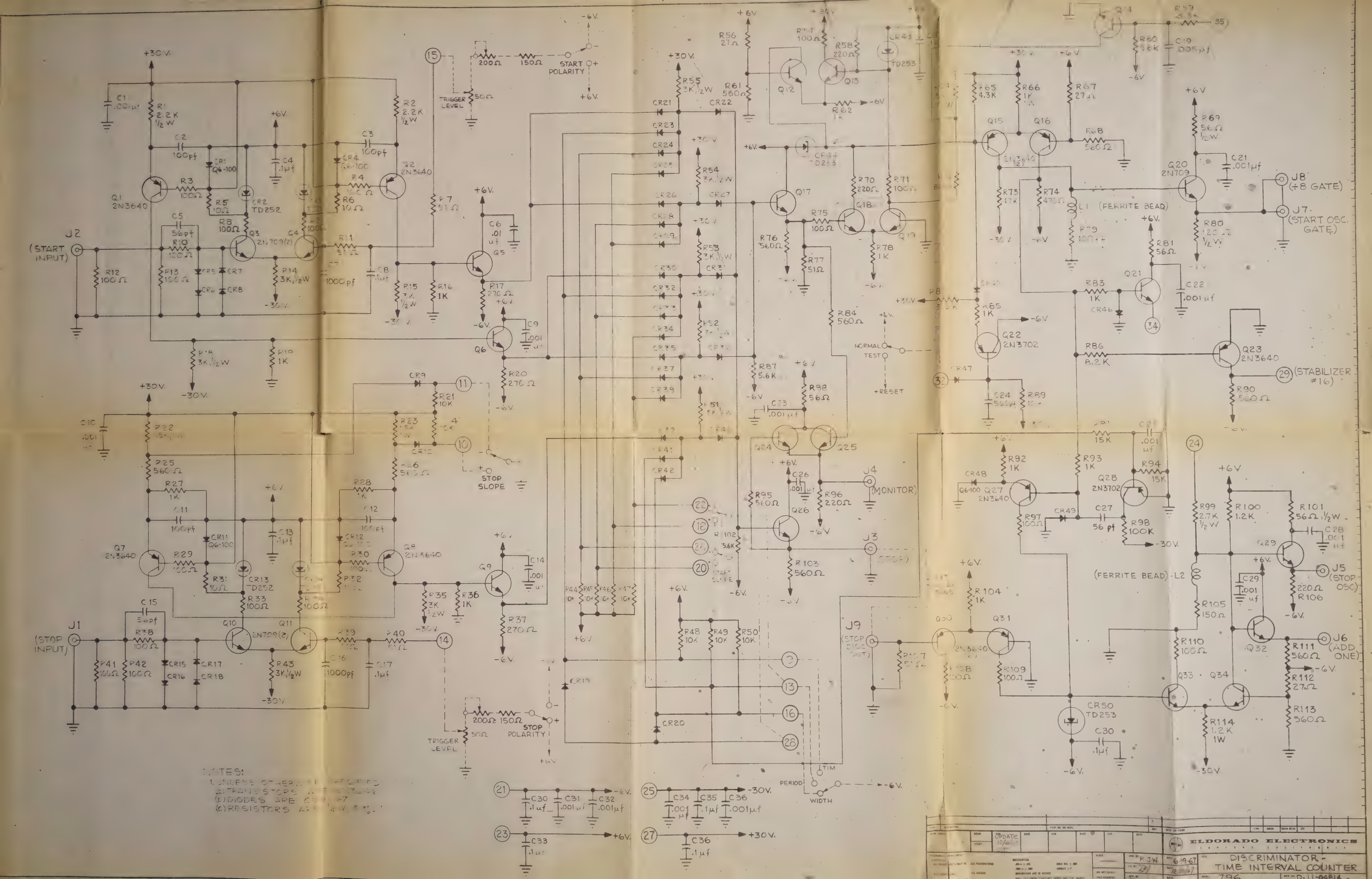
NOTES:
1. ALL RESISTORS 1/4W, ±5%
2. ALL DIODES P/N D00600
3. ALL TRANSISTORS P/N T04090
4. L1 IS A FERRITE BEAD

ELDORADO ELECTRONICS
CONCORD, CALIFORNIA

25 MHZ DCU
MODEL 945A
DWG NO 211-945-B


TRIG. MON.
4
5
7
−REGULATOR 32-4507
+REGULATOR 32-3092
DISCRIMINATOR 32-4814
1 STOP INPUT
2 START INPUT
9
8
LOGIC 32-4804
REMOTE CONTROL 32-5586
OPTION
DELAY LINES
10
3
MEMORY READOUT 32-4962
25 MHz DCU 32-3968
32-4962
2.5 MHz DCU 32-3967
32-4962
32-3968
32-4962
32-3967
32-4962
250 KHz DCU 32-3966
32-4962
32-3966
OPTION
OVEN REGULATOR 32-4883
TEST PULSER 32-4942
TEST PULSE
11
FUSES
−12 5.0 AMP.
−30 0.5 AMP.
+12 5.0 AMP.
+30 1.0 AMP.
STOP OSC. POT
12
15
6
COINC. 32-4803
13
14
STOP CKT. 32-4943
STOP OSC.
16
ADD ONE 32-4948
17
STABILIZER 32-5011
START OSC
19
18
1 MHz OSC.
21
MULT. 32-4547
32-4962
32-3966
32-4962
32-3966
32-4962
32-3966
OPTION
CARD LOCATION AND CABLE CONNECTION DIAGRAM


TRIG. MON.
4
5
7
−REGULATOR 32-4507
+REGULATOR 32-3092
DISCRIMINATOR 32-4814
1 → STOP INPUT
2 → START INPUT
9
8
LOGIC 32-4804
REMOTE CONTROL 32-5586
OPTION
DELAY LINES
10
3
MEMORY READOUT 32-4962
25 MHz DCU 32-3968
32-4962
2.5 MHz DCU 32-3967
32-4962
32-3968
32-4962
32-3967
32-4962
250 KHz DCU 32-3966
32-4962
32-3966
OPTION
OVEN REGULATOR 32-4883
TEST PULSER 32-4942
TEST PULSE
11
FUSES
−12 5.0 AMP.
−30 0.5 AMP.
+12 5.0 AMP.
+30 1.0 AMP.
STOP OSC. POT
12
15
13
COINC. 32-4803
14
STOP CKT. 32-4943
STOP OSC
16
ADD ONE 32-4948
17
STABILIZER 32-5011
START OSC
18
19
1MHz OSC.
21
MULT. 32-4547
6
32-4962
32-3966
32-4962
32-3966
32-4962
32-3966
OPTION
CARD LOCATION AND CABLE CONNECTION DIAGRAM


J2 (START INPUT)
J1 (STOP INPUT)
J8 (÷8 GATE)
J7 (START OSC. GATE)
J6 (ADD ONE)
J5 (STOP OSC)
J4 (MONITOR)
J3 (STOP)
J9 (STOP DISC. OUT)
START POLARITY
STOP POLARITY
TRIGGER LEVEL
NORMAL TEST
+RESET
PERIOD WIDTH
(FERRITE BEAD) L1
(FERRITE BEAD) L2
(STABILIZER #16)
Q1 2N3640
Q2 2N3640
Q3 2N709(2)
Q4
Q5
Q6
Q7 2N3640
Q8 2N3640
Q9
Q10
Q11 2N709(2)
Q12
Q13
Q15
Q16
Q17
Q18
Q19
Q20 2N709
Q21
Q22 2N3702
Q23 2N3640
Q24
Q25
Q26
Q27 2N3640
Q28 2N3702
Q31
Q32
Q33 · Q34
CR1 Q6-100
CR2 TD252
CR3 Q6-100
CR4 Q6-100
CR11 Q6-100
CR13 D252
CR48 Q6-100
CR50 TD253
TD253
+30V.
+6V.
-6V.
-30V.
NOTES:
1. UNLESS OTHERWISE SPECIFIED
(a) TRANSISTORS ARE
(b) DIODES ARE
(c) RESISTORS ARE
UPDATE 12/6/67
ELDORADO ELECTRONICS
DISCRIMINATOR - TIME INTERVAL COUNTER
796
6-19-67
R. J.W.

J2 (START INPUT)
J1 (STOP INPUT)
J8 (÷8 GATE)
J7 (START OSC. GATE)
J5 (STOP OSC.)
J6 (ADD ONE)
J3
J9
(STABILIZER #16)
(MONITOR)
(FERRITE BEAD) L1
(FERRITE BEAD) L2
START POLARITY
STOP POLARITY
TRIGGER LEVEL
STOP SLOPE
NORMAL TEST
RESET
PERIOD
WIDTH
TIM

NOTES:
1. UNLESS OTHERWISE SPECIFIED
   a) TRANSISTORS ARE [illegible]
   b) DIODES ARE [illegible]
   c) RESISTORS ARE 1/4 W, 5%.

		UPDATE 12/6/67					

ELDORADO ELECTRONICS
CONCORD CALIFORNIA

DRAWN BY R.J.W. 6-19-67
CK BY [illegible] 12/20/67

DISCRIMINATOR - TIME INTERVAL COUNTER
MODEL 796
DWG # D-11-04814 -

ZONE	SYM	REVISION	ECO	BY	DATE	CHK'D

+ 305 V

C12 .1 450V

R40 560K, 1/2W

CR1 SC-10

Q1 2N1546

C1 900MF 75V

R1 7.5Ω, 3W

T1

9 430VCT 8 10

C2 4000 UFD 35V

1 2ASB 5

Q2 2N544

R2 1.2K

Q3 2N1544

POWER SW FRONT PANEL

1ASB 2

M FAN

LINE FILTER

C-45-3,5,7

115V 230V SW REAR PANEL

OSC POWER XMFR OSC CHASSIS

R4 100Ω

C4 50UF 50V

R3 2.7K

Q8 2N3703

R41 150Ω*

R5 8.2K

Q9 2N3703

C5 1UF 250V CW

CR4 IN753A

CR3 3-1001

R11 1.5K

R9 2.2K

R10 1.5K

C7 10MF 50V

R8 500Ω +30V

8 6 2 1/2 AFB -30V

— REGULATOR A-32-04507

500Ω, -12V R39

R6 1K

R7 1.5K CW

Q7 4-1002

C3 200MF 15V

R12 680Ω

Q13 4-1002

C6 200MF 15V

R13 330Ω

R14 250Ω -6V

CW

Q14 4-1002

Q15 4-1002

R17 560Ω

R16 560Ω

R18 820Ω

C9 50UF 15V

C8 10MF 15V

12 -12V

10 -6V

C22 .1 MFD

12 4 8 1/2 AFB +30V

C18 OMF 50V

Q4 2N3054

C10 900MF 75V

5 7.6VCT 6 7

CR5 CR6 CR7 CR8

R19 7.5Ω 3W

R20 1.8K 1W

13 28VCT 12 11

CR12 CR11 CR10 CR9

CR13 3-1001

C19 .1 UF

Q12 2N3053

R24 1.5K

R25 500Ω +12V CW

R28 1K

R30 3.9K

Q16 2N3053

CR16 3-1001

C16 50UF 15V

C17 50MF 15V

C11 4000 UFD 35V

2ASB 7 3

Q5 2N544

Q6 2N1544

R21 2.7K

C13 50UF 50V

R42 150Ω

Q17 2N3054

R23 2.2K

C14 1UF 250V

Q11 2N2712

CR14 3-1001

CR15 IN753A

R29 1.5K

R26 500Ω +30V CW

R27 470Ω

+ REGULATOR A-32-03092

R32 220Ω

R31 220Ω

R34 560Ω

R36 560Ω

Q17 2N2712

Q18 2N2712

R37 250Ω, +6V CW

R33 3.3K

C15 200MF 15V

R35 3.3K

R38 470Ω

11 +6V

3 +12V

C21 .22 UFD

2. DIODES ARE SC-2

1. RESISTORS ARE 1/4W, 5%

NOTES UNLESS OTHERWISE SPECIFIED

ELDORADO ELECTRONICS CORCORD, CALIFORNIA

SCHEMATIC, POWER SUPPLY & REGULATOR

MODEL 796 DRW NO D-11-04917

DRN BY CHEEC 1/15/67

CK BY RM 1/26/67

ZONE	SYM	REVISION	ECO	BY	DATE	CHK'D

+ 305 V

C 12 .1 MF 450 V

R 40 560K, 1/2W

CR 1 SC-10

Q 1 2N1546

C 1 900 MF 75 V

R 1 7.5Ω, 3W

T1

9 430VCT 3 10

C 2 4700 MFD 35 V

1 2ASB 5

Q 2 2N1544

Q 3 2N1544

R 2 1.2K

R 4 100Ω

C 4 50 MF 50 V

R 3 2.7K

Q 8 2N3703

R 41 150Ω

R 5 8.2K

Q 9 2N3703

C 5 .1 MF 250 V

CR 4 IN753A

CR 3 3-1001

500Ω, -12V R 39

R 6 1K

R 7 1.5K

CW

Q 7 4-102Z

C 3 200 MF 5V

R 12 680Ω

Q 13 4-102Z

C 6 200 MF 15V

R 13 470Ω

R 14 2.5K -6V

Q 14 4-102Z

Q 15 4-102Z

R 16 560Ω

R 17 560Ω

R 18 820Ω

C 8 50 MF 15V

C 9 50 MF 15V

R 8 5000 +30V

R 9 2.2K

R 15 1K

C 7 10 MF 50 V

8 6 2 1/2 AFB → -30V

12 → -12V

10 → -6V

C 22 .2 UFD

9 4 5 1/2 AFB → +30V

— REGULATOR A-32-04507

POWER SW FRONT PANEL

1ASB 2

4

3

M FAN

6

4

LINE FILTER

C 45-3451

115 V 23A

115 230V SW REAR PANEL

~275 V

OSC POWER XMFR OSC CHASSIS

5 7 6VCT 6 7

13 16 28VCT 12 11

C 11 4000 UFD 35 V

2ASB 7 3

Q 5 2N1544

Q 6 2N1544

Q 4 2N3054

C 10 900MF 75 V

CR 5

CR 6

CR 7

CR 8

R 19 7.5Ω 3W

R 20 4.8K 1W

C 19 .1 MF

CR 12

CR 13 3-1001

CR 11

CR 10

CR 9

Q 12 2N3053

CW

R 24 1.5K

R 25 500Ω +12V

R 28 1K

R 30 3.9K

CR 16 3-1001

Q 16 2N3053

C 17 MF V

R 21 2.7K

C 13 MF 50V

R 42 150Ω

2N3053

R 22 Ω

R 23 Ω

Q 11 2N2712

C 14 .1UF 250 V

CR 14 3-1001

CR 15 IN753A

R 29 1.5K

R 26 500Ω, +30V

R 27 470Ω

C 18 MF 30V

+ REGULATOR A-32-03092

R 32 220Ω

R 31 220Ω

Q 17 2N2712

C 15 200MF 15V

R 33 3.3K

R 34 560Ω

Q 18 2N2712

R 35 3.3K

CW

R 36 560Ω

R 37 250Ω, +6V

R 38 470Ω

C 16 50 MF 15V

11 → +6V

3 → +12V

C 21 .22 UFD

2. DIODES ARE SC-2

1. RESISTORS ARE 1/4W, 5%

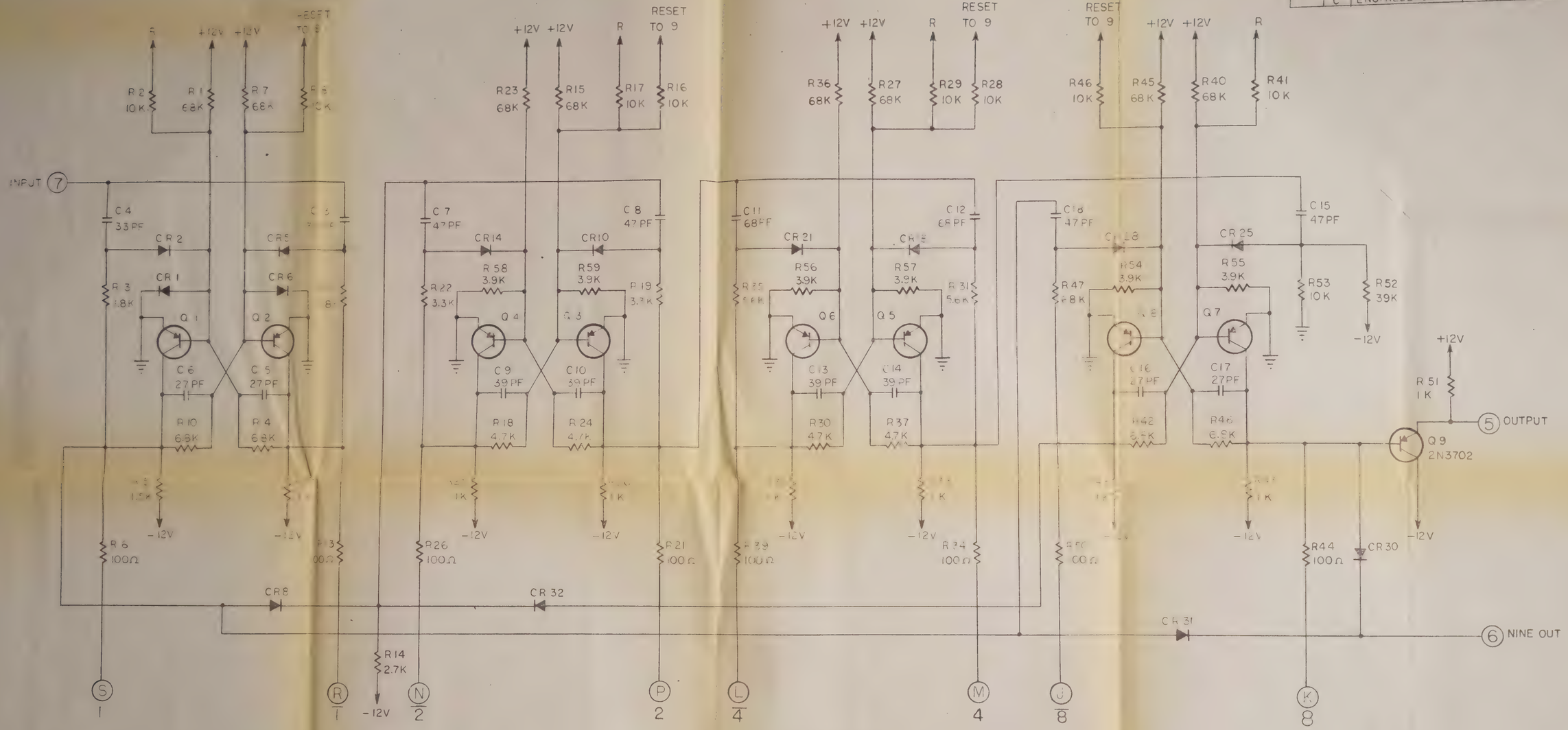
NOTES UNLESS OTHERWISE SPECIFIED

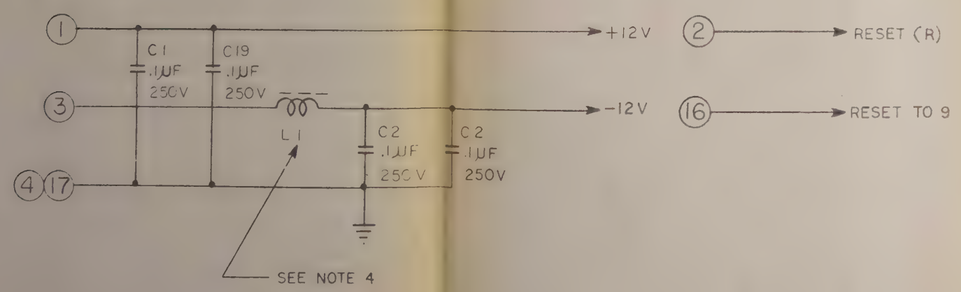
ELDORADO ELECTRONICS CORCORAN, CALIFORNIA

SCHEMATIC, POWER SUPPLY & REGULATOR

MODEL 796 DWG NO D-11-04915

ZONE	SYM	REVISION	ECO	BY	DATE	CHKD
	B	NEW REF. #'S, ~~ENG. RELEASE~~		[illegible]		
	C	R42,48 WERE 10K	1856	GT	12/3/66	
	C	ENG. RELEASE	—			





NOTES: UNLESS OTHERWISE SPECIFIED

1. TRANSISTORS : P/N T04110
2. DIODES : P/N D00600
3. RESISTORS: 1/4W, ±5%
4. L1 IS A FERRITE BEAD.

ELDORADO ELECTRONICS
CUPERTINO, CALIFORNIA

DRN CHERL 10/10/66
CK. BY
APP. BY
DATE

2.5 MHZ DCU

MODEL 245A

ZONE	SYM	REVISION	ECO	BY	DATE	CHKD
-	A	ENG. RELEASE	-			

NOTES: UNLESS OTHERWISE SPECIFIED

1. TRANSISTORS ARE P/N TO46C
2. RESISTORS: ¼W, 5%
3. DIODES ARE P/N 1000
4. [illegible]

INPUT (7)

RESET TO 9

+12V +12V R

R2 4.7K R1 68K R7 68K R23 68K R15 68K R17 10K R16 10K R36 68K R27 68K R29 10K R28 10K R46 10K R45 68K R40 68K R41 10K

C4 220PF C7 470PF C8 470PF C11 680PF C12 680PF C18 220PF C15 470PF

CR2 CR5 CR14 CR10 CR21 CR18 CR25

R3 2.7K CR1 CR6 R22 3.3K R58 3.9K R59 3.9K R19 3.3K R35 5.6K R56 3.9K R57 3.9K R31 5.6K R47 15K R54 3.9K R55 3.9K R53 10K R52 39K

Q1 Q2 Q4 Q3 Q6 Q5 Q7

C6 270PF C5 270PF C9 390PF C10 390PF C13 390PF C14 390PF C16 270PF C17 270PF

R10 6.8K R4 6.8K R18 10K R24 10K R30 10K R37 10K R48 10K

1.5K 1K 1K 1K 1K 1K 1K 1K

-12V -12V -12V -12V -12V -12V -12V -12V -12V

R6 100Ω R26 100Ω R21 100Ω R39 100Ω R34 100Ω R50 100Ω R44 100Ω CR30

CR8 CR32 CR31

R14 2.7K

-12V

(5) OUTPUT

(6) NINE OUT

(S) 1 (P) 2 (L) 4 (M) 4 (J) 8 (K) 8

(1) → +12V

(3) → -12V

(4)(17)

C1 .1μF 250V C19 .1μF 250V C2 .1μF 250V C20 .1μF 250V

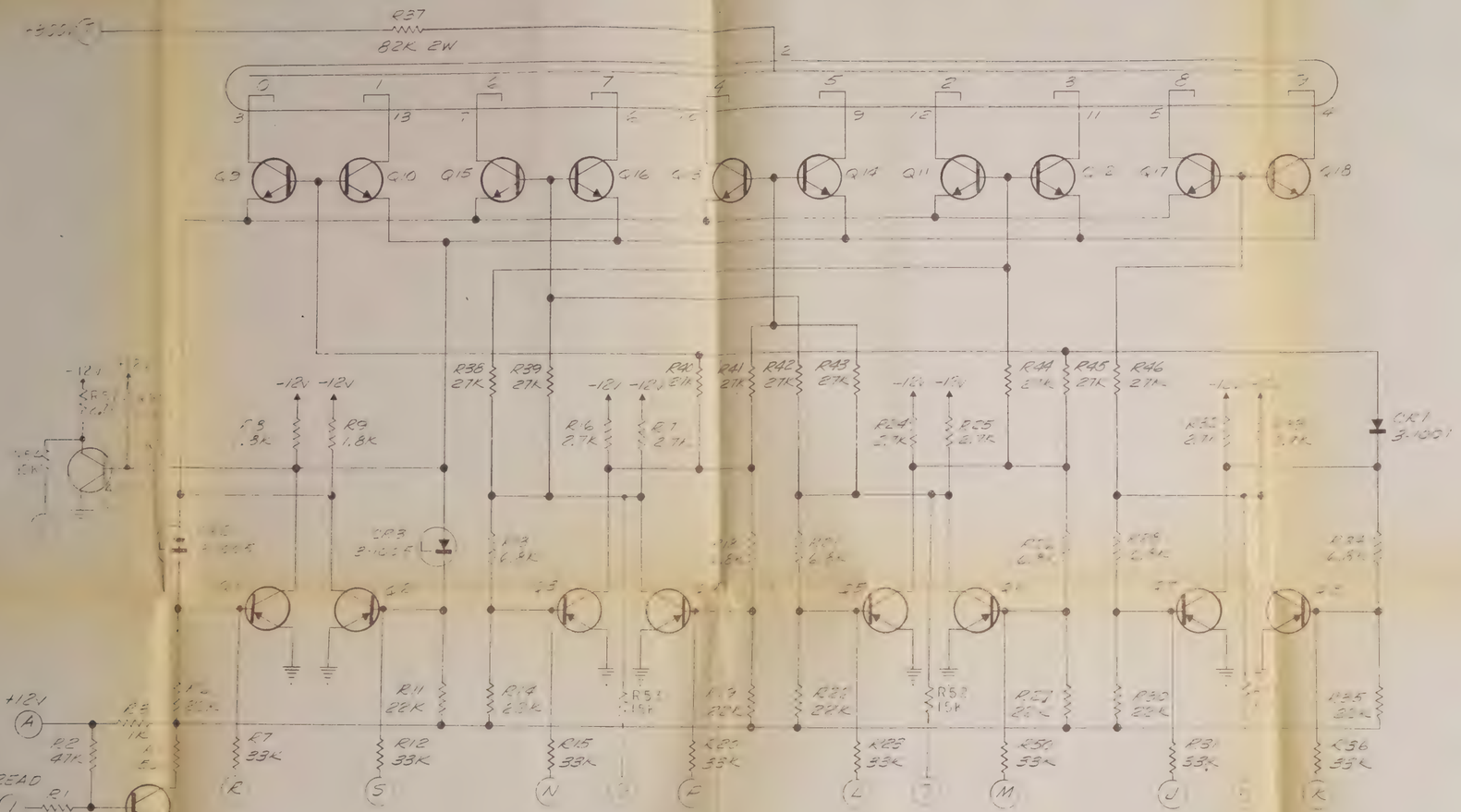
L1

SEE NOTE 4

(2) → RESET (R)

(16) → RESET TO 9

| | | |



NOTES: UNLESS OTHERWISE SPECIFIED
1) ALL RESISTORS 1/4W ± 5%, IN OHMS.
2) Q1 THRU Q8 = 4-1002 (MIN β = 60)
Q9 THRU Q18 = 4-1001

ELDORADO ELECTRONICS
CONCORD CALIFORNIA

+300V (15)

+6V (5) — 10Ω R1

RESET (12) — C1 .001 μf

-6V (3) — R2 4.7Ω

-30V (7) — R3 10Ω

GND (1) (18)

C2 .47μf

CR1 CDG267

R4 1K

R5 10K

C4 .01μf

R6 330Ω

R7 330Ω

C5 330

R8 4.7K

C6 .001μf

R10 3.2K

CR2 CDG267

2N2046 Q3

R11 5.6K

R12 3.3K

C7 .01μf

C8 470

R13 470Ω

R14 5.6K

R15 27K, 1W

C9 8, 350V

R16 10K, ½W

IN3044B CR3, 100V

R17 10K ½W

R18 25K ½W. AVALANCHE ADJ

R-22 1K

Q4 2N3646

C10 82

R20 ½W 82Ω

C11 .001μf

NOTE 6

TEST PULSE OUTPUTS

NOTE : UNLESS OTHERWISE SPECIFIED

1. ALL RESISTOR VALUES IN OHMS, ±5%, ¼W
2. ALL CAPACITOR VALUES IN MICROFARADS, ±5%, 300V.
3.
4.
5. (X) REFERS TO PCB CONNECTOR PIN DESIGNATION
6. NOMINAL ~~27Ω~~, FINAL VALUE DETERMINED PER AVALANCHE CHARACTERISTICS R20 & R21 MUST BE THE SAME VALUE (TO OBTAIN 6 TO 13 VOLTS OUTPUT INTO 50Ω.)

R	C	CR	Q	L
R22	C11	CR3	Q4	L1

UNLESS NOTED:
ALL RESISTORS ½W. ±5%
ALL CAPACITORS 500V. ±20%

UNITS IN Ω, F, & H
μμ = p = 10^{-12}
.001μ = n = 10^{-9}
μ = 10^{-6}
m = 10^{-3}
K = 10^{3}
M = 10^{6}

DWG. CHNG.	BY	DATE

Eldorado Electronics
Berkeley, California

DRAWN BY: C.T.	DATE 10-31-67
CHECKED: RJ	DATE 11/6/67
APPROVED: [illegible]	DATE 22 Nov 67

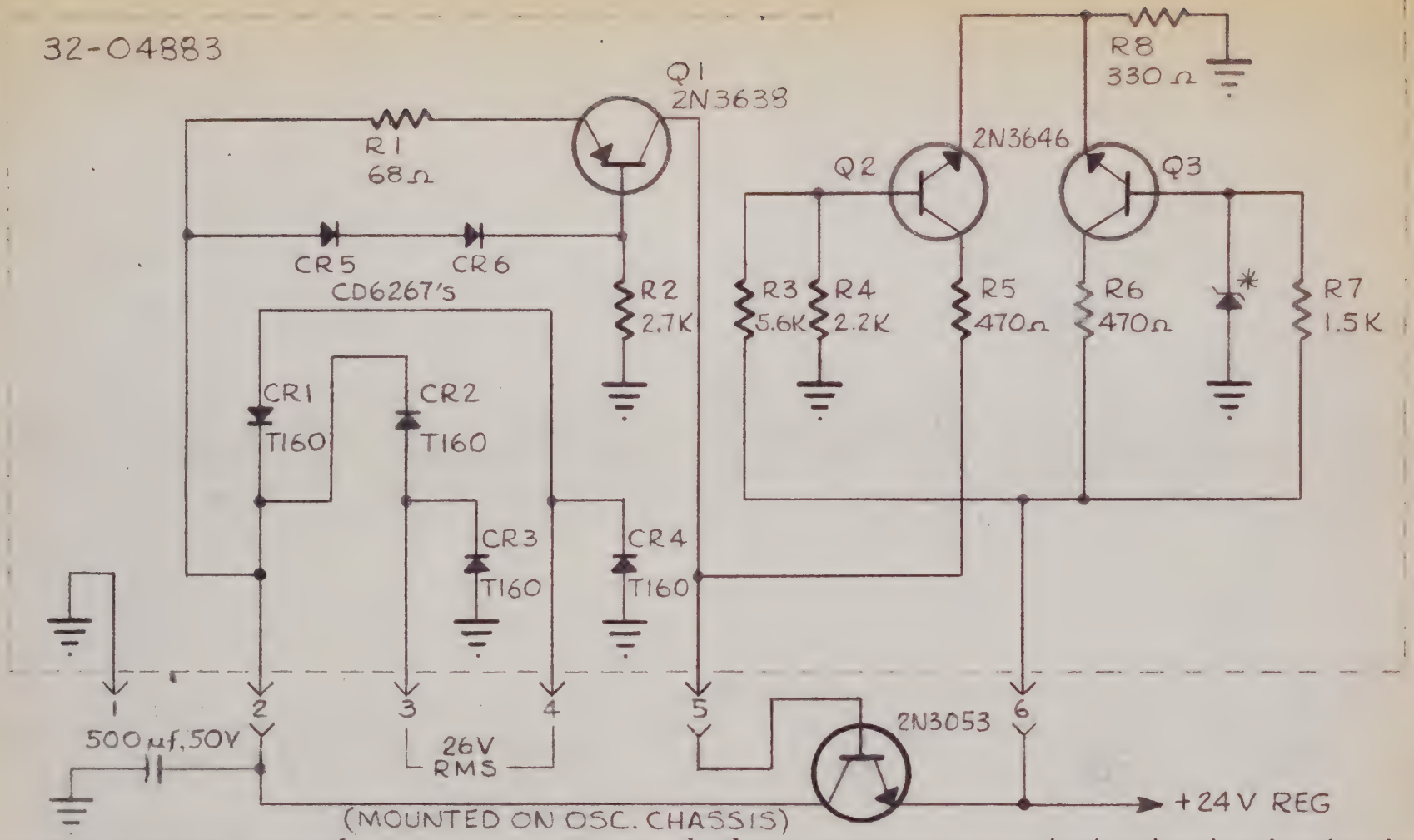
SCHEMATIC, TEST PULSER

MODEL 7[illegible]

DWG. NO. C-11-04942 ISSUE

NOTES:

1. * DIODE IS AN IN754A.



ITEM	DESCRIPTION	PART NO OR MATL	REV	SPEC OR FINISH	CHG	QUAN	QUAN.REQD	ISS.

WORK ORDER	QUAN. START	ECR	DATE	ECR	DATE	ECR	DATE

ELDORADO ELECTRONICS
CONCORD CALIFORNIA

TOLERANCES UNLESS NOTED:
ELECTRICAL
ALL RESISTORS ¼ WATT ± ALL TRANSISTORS
ALL CAPACITORS ALL DIODES
MECHANICAL
.00 = ± .015 HOLE DIA ± .005
.000 = ± .005 ANGLES ±1°
DIMENSIONS ARE IN INCHES.
KEEP FREE FROM SCRATCHES, BURRS AND TOOL MARKS

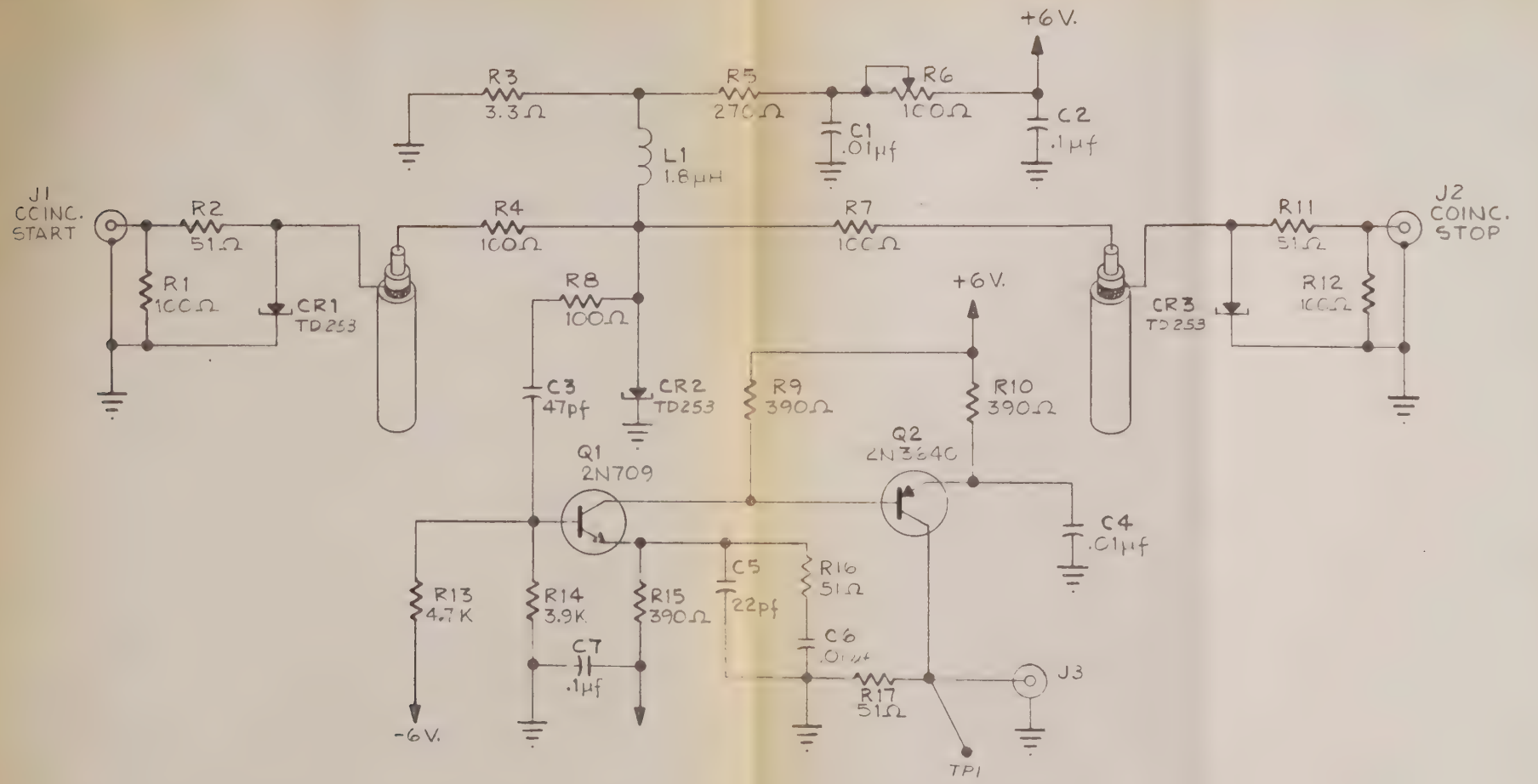
SCALE —

DO NOT SCALE THIS DRAWING

DRW BY Cher DATE 11/1/67
CK BY RM DATE 12/19/67
APP BY [illegible] DATE [illegible]

TITLE SCHEMATIC, OPTION D&E
OVEN POWER REGULATOR

MODEL 736 DRW NO A-11-04949-



ITEM	DESCRIPTION				PART NO OR MATL			REV	MFD OR FINISH			CMC	QUAN	QUAN REQD	ISS
WORK ORDER		QUAN	ECR	DATE	ECR	DATE	ECR	DATE							
		START													

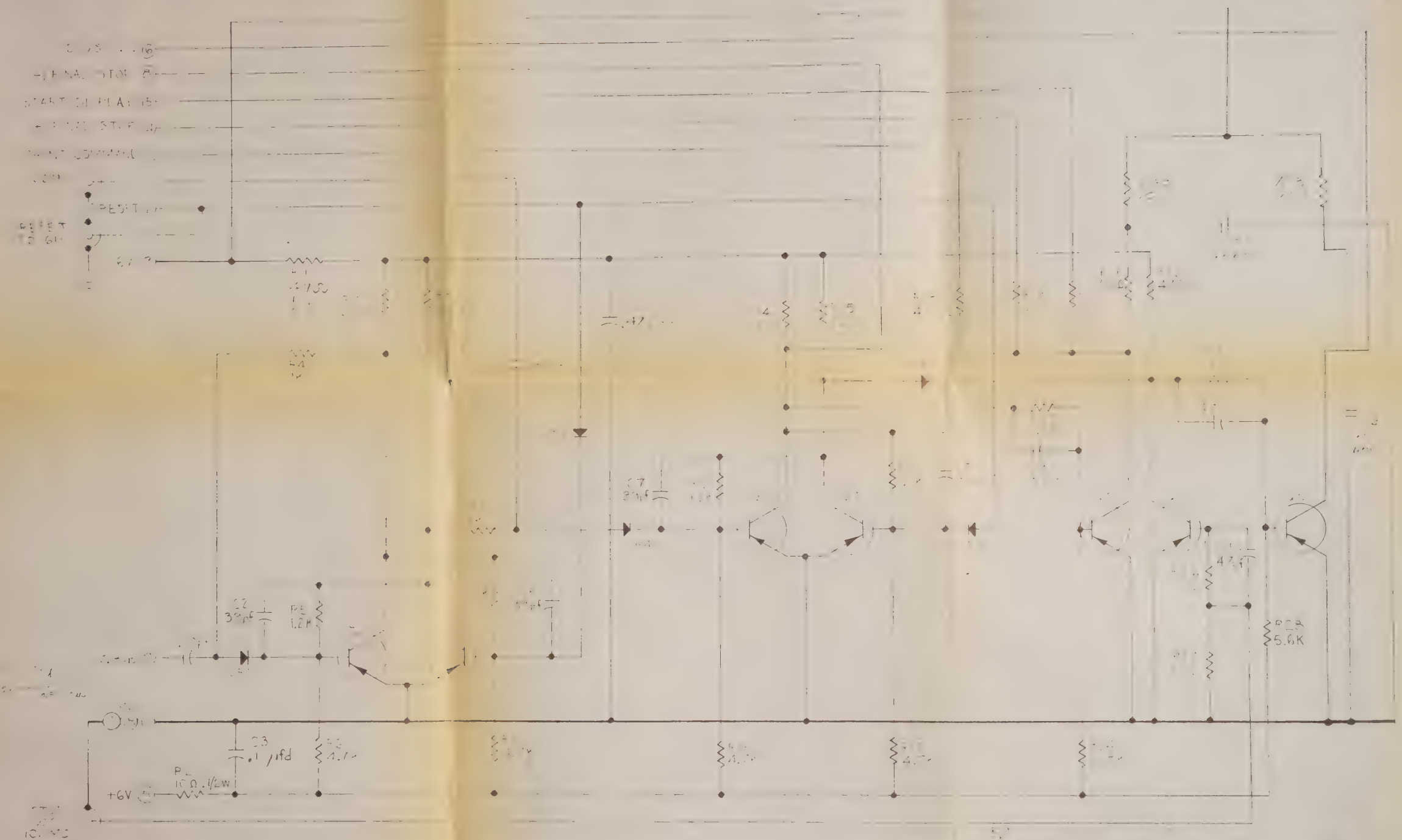
ELDORADO ELECTRONICS
CORONA, CALIFORNIA

TOLERANCES UNLESS NOTED:
ELECTRICAL
ALL RESISTORS ± WATT 5% ALL TRANSISTORS
ALL CAPACITORS ALL DIODES
V %
MECHANICAL
.00 — ± .015 HOLE DIA ± .005
.000 — ± .005 ANGLES ± 1°
DIMENSIONS ARE IN INCHES
KEEP FREE FROM SCRATCHES BURRS AND TOOL MARKS

SCALE —
DO NOT SCALE THIS DRAWING

DRW BY R.J.W. DATE 8-22-67
CK BY DATE 12/20/67
APP BY DATE

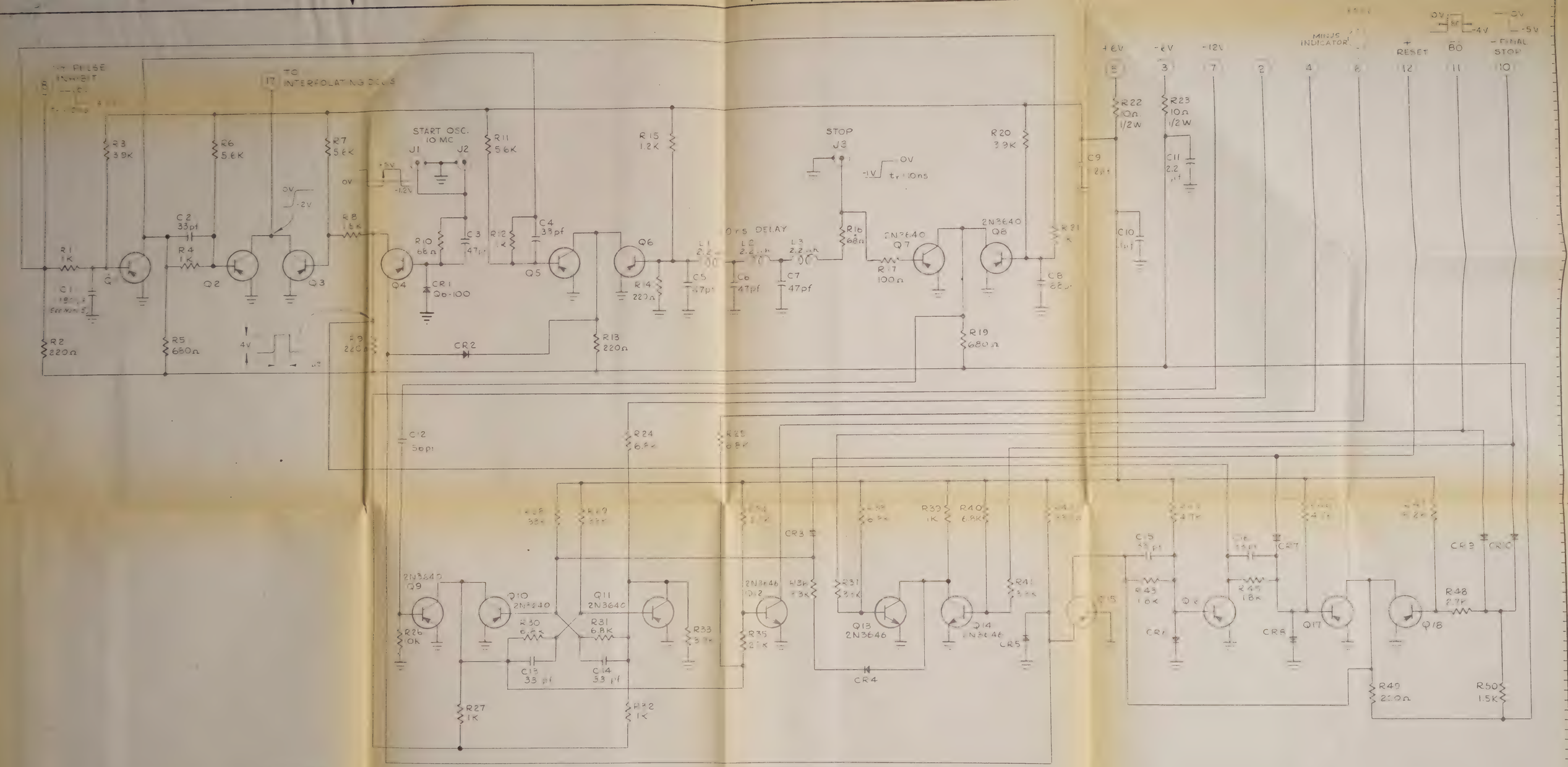
TITLE COINCIDENCE
MODEL 796
DRW NO B-11-04803-

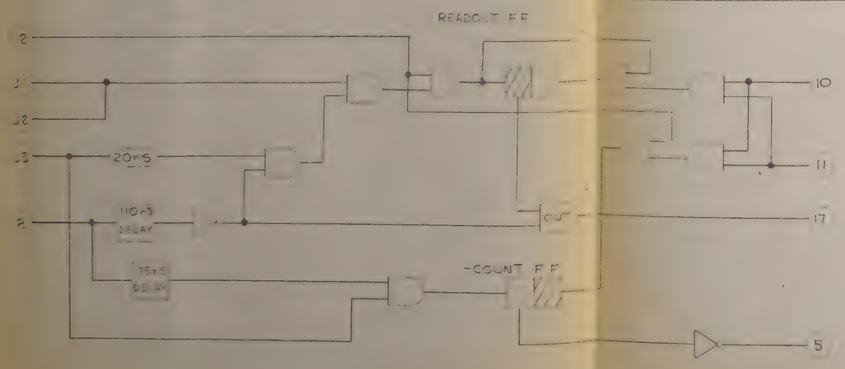


NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTORS ¼W, ±5%
2. ALL CAPACITORS 300V, ±5%
3. ALL DIODES CD6207
4. ALL TRANSISTORS 2N718
5. (X) REFERS TO PCB CONNECTOR PIN DESIGNATION

UNLESS NOTED ALL RESISTORS ½W. ±5% ALL CAPACITORS 500V. ±20% UNITS IN Ω, F, & H µµ = p = 10^{-12} .001µ = n = 10^{-9} µ = 10^{-6} m = 10^{-3} K = 10^{3} M = 10^{6}	DWG. CHNG.	BY	DATE	Eldorado Electronics Berkeley, California

DRAWN BY: [illegible]	DATE 10/31/67	
CHECKED: RM	DATE 12/20/67	
APPROVED: [illegible]	DATE [illegible]	
STOP [illegible]		MODEL [illegible]
DWG. NO. C-11-04943	ISSUE	





NOTES: UNLESS OTHERWISE SPECIFIED

1. RESISTORS: 1/4W, ±5%
2. CAPACITORS: 300V, ±5%
3. TRANSISTORS: 4-1003
4. DIODES: CD6267
5. NOMINAL VALUE OF C1 MAY BE CHANGED AT TEST.

ELDORADO ELECTRONICS
CONCORD, CALIFORNIA

SCHEMATIC, ADD ONE LOGIC

MODEL 796 — DWG No D-11-04948 -

GND

-6V

+6V

DETECTOR

L1
240μH

T.P.1

+6V.

R1
56Ω

R6
56Ω

C1
220pf

R8
1.8K

R9
100Ω

C2
.01μf

Q4

Q15
2N3646

R5
10Ω

J1

FD777
CR1

-30V

+30V

TP2

J3

CR17
CR16

CR20

270
2W

CR19

CR18

Q7

B2K

+6V.

R22

R23

R29
22Ω

C8
.0047μf

-30V.

R27
2.2Ω

C9
.01μf

Q10
2N3640

R28
100Ω

CR2
IN4152

CR4
FD300
or
IN4152

CP4
IN4152

+6V.

R31
27Ω

MEMORY GATE (FLIP-FLOP)

R34
4.7K

C11
33pf

CR9
IN4152

C12
220pf

R35
5.6K

-30V.

C17

OSCILLATOR ADJUST

-30V

8 μS

Q16
2N3640

R36
2.7K

R37
2.7K

Q17
2N3640

C20
220pf

CR14
IN4152

CR15
IN4152

R38
4.7K

R39
1K

R40
3.9K

R41
10K

Q13
2N3640

Q14
2N3640

TP3

CR11
IN4152

CR12

C17
100pf

C5
270pf

C16
33pf

CR13
IN4152

R42
2.2K

R43
22K

R44

R45
1.2K

R46
47K

R47
12K

C18
.01μf

R66
27Ω

-6V.

START

RESET

RESET

+6V

ELDORADO ELECTRONICS

P.C.B. SCHEMATIC - STABILIZER

ZONE	SYM	REVISION	ECO	BY	DATE	CHKD
	B	2.2K was 5.6K 290Ω was 56Ω 1/2W was 1W	1434	R.A.	10/3/67	

V.H.F ÷8

+30V (9)
C1 .001µf
R2 5.6K
R6 100Ω
R14 100Ω
R18 100Ω
R22 100Ω
R26 100Ω
R3 2.7K
C5 .01µf
R7 1.5K 1W
C6 .01µf
C9 .05pf
R15 22K
C11 .01µf
R19 22K
C15 .001µf
R23 22K
C19 .001µf
R27 15K
1MHz (.2V RMS MIN.) (17)
C2 .01µf
R1 12K
Q1 2N3646
Q2 2N3640
Q3 2N3640
R17 39K
C12 390pf
R21 8.2K
C16 390pf
1/2W R25 1.8K
C20 560pf
1/2W R29 1.8K
C23 .001µf
R30 100Ω
Q4 2N3640 X5
Q5 2N3640 X4
Q6 2N3640 X4
Q7 2N3640
R4 2.7K
R8 1K
C7 100pf
R9 330Ω
C10 220pf
L2 1.8µH 3.0µH
L3 .27µH .40µH
C13 470pf
C14 .0015µf
C17 220pf
C18 680pf
L4
C28
C21 27pf
C22 82pf
C24 18pf
C29
L5
1MHz MONITOR OUTPUT (16)
C3 .01µf
R5 1K
R13 100Ω
R10 150Ω
R12 180Ω
L1 4.7µH
CR1 IN4152
R16 10K
R20 10K
R24 10K
R28 6.8K
R11 22Ω
C8 .1µf

80 MHz MULTIPLIER

-6V (13)

5 → +6V
C32 .05µf

3, 4 → -6V
C4 .001µf

1, 18
⏚

+6V.
CR2 N749 4.3V
C30 .001µf
R34 510Ω, 1W
R35 330Ω
R36 1.2K, 1W
R37 390Ω
≈43nH
CR3 FD777
Q8 2N3640
J2
J3
Q9 2N3640
CR7 FD777
+6V.
C25 .001µf
R38 51Ω
R39 100Ω
R40 100Ω
Q10 2N3646
Q11 2N3646
+6V.
R44 560Ω
J4
51Ω
R31 100Ω
C26 2pf
CR5 HPA2301
R33 100Ω
CR4 MA4740
R32 270Ω
CR6 TD253
R45 27Ω
R41
R42 2K
C31 .001µf
R47 270Ω
R46 560Ω
-6V.
-6V.
-6V.
Q12 2N3646
R48 82Ω
C27 .001µf
J1
CR8 FD777
R49 51Ω
R50 470Ω
R51 510Ω
-6V.

ITEM	DESCRIPTION	PART NO OR MATL	REV	MFG OR FINISH	CHG	QUAN	MODEL NO.
MADE FROM							

	QUAN	ECR	DATE	ECR	DATE	ECR	DATE
	START						

ELDORADO ELECTRONICS
COMPTON CALIFORNIA

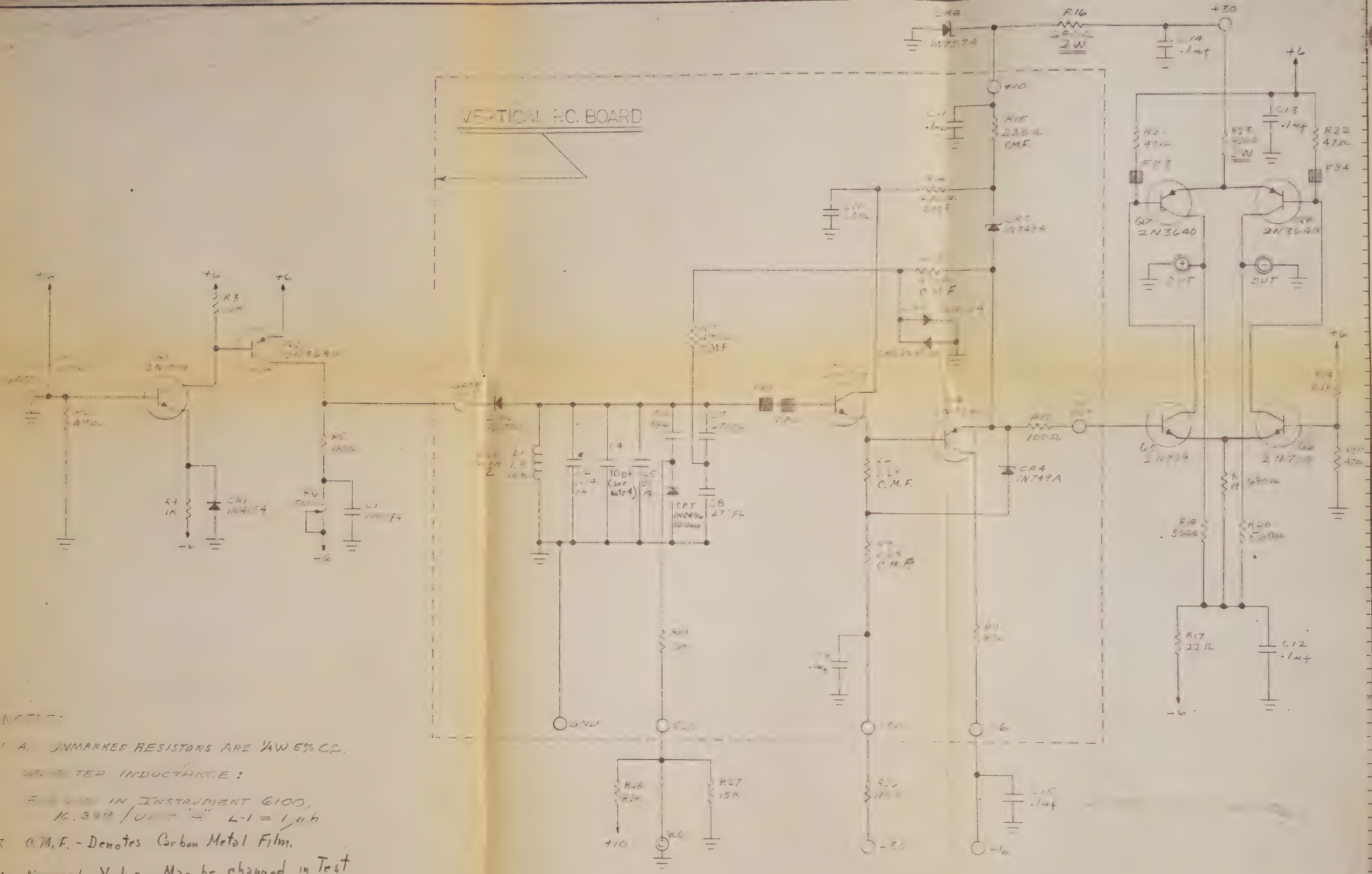
TOLERANCES UNLESS NOTED:
1 FRACTIONAL
ALL RESISTORS ± WATT 5%
ALL CAPACITORS
ALL TRANSISTORS
ALL DIODES
MECHANICAL
.XX = ± .010
.XXX = ± .005
DIMENSIONS ARE IN INCHES
KEEP FREE FROM SCRATCHES, BURRS AND TOOL MARKS
BREAK SHARP ± 005
ANGLES ± 1°

SCALE NONE
DO NOT SCALE THIS DRAWING

DRWN BY R.J.W. 12-20-66
CK BY [illegible] 4/3/67
APP BY
DATE

TITLE P.C. BOARD SCHEMATIC-
80 MHz MULTIPLIER - F & B

MODEL
DRWG NO 11-01547



NOTE:

1. A. UNMARKED RESISTORS ARE ¼W 5% C.C.

   [illegible] TED INDUCTANCE:

   [illegible] IN INSTRUMENT 6100, 16.3[illegible] / UNIT "4" L-1 = 1 μh

3. C.M.F. - Denotes Carbon Metal Film.

4. Nominal Value - May be changed in Test

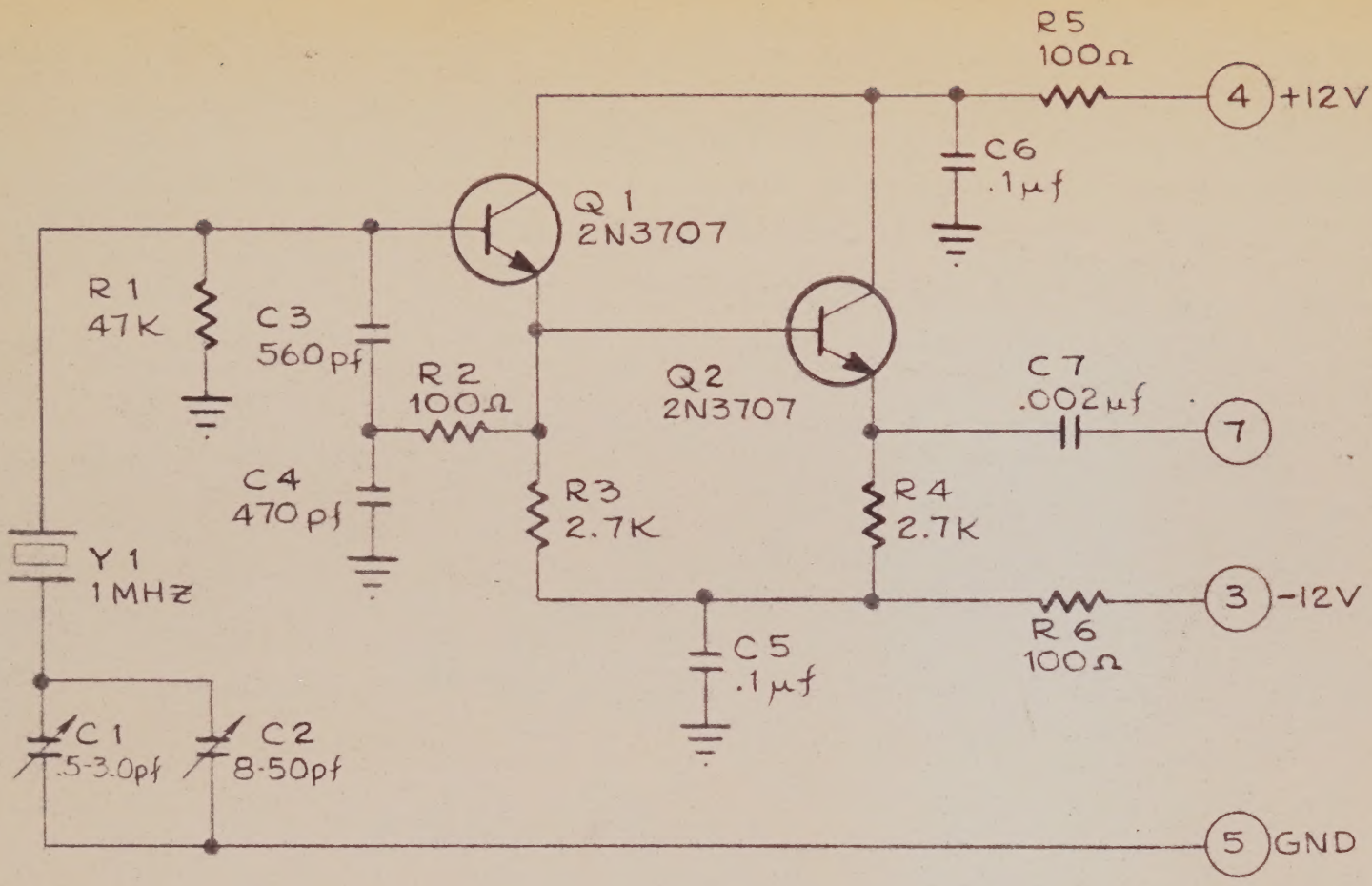
ITEM	DESCRIPTION			PART NO. OR MATL		REV	MFG OR FINISH								
WORK ORDER	QUAN	L-S	DATE		DATE		DATE				ENG	QUAN	DRAWING	ISS	
	START														

TOLERANCES UNLESS NOTED
ELECTRICAL
ALL RESISTORS ½ WATT 5% ALL TRANSISTORS
ALL CAPACITORS ALL DIODES
MECHANICAL
.00 = ± .015 HOLE DIA = .005
.000 = ± .005 ANGLES ±1°
DIMENSIONS ARE IN INCHES
BREAK ALL SHARP EDGES AND REMOVE BURRS

CALC ---
DRAWN 4H DATE 3 1 65
CK BY DATE
APP'D DATE

ELDORADO ELECTRONICS
CONCORD, CALIFORNIA

TITLE: START UP OSCILLATOR & [illegible]
SIZE: B/C 196 DRAWING [illegible]



ITEM	DESCRIPTION	PART NO. OR MATL	REV.	MFD OR FINISH	CHG.	QUAN.	QUAN. REQD	ISS.

WORK ORDER	QUAN. START	ECR	DATE	ECR	DATE	ECR	DATE

ELDORADO ELECTRONICS
CONCORD CALIFORNIA

TOLERANCES UNLESS NOTED:
ELECTRICAL
ALL RESISTORS ¼ WATT 5% ALL TRANSISTORS
ALL CAPACITORS ALL DIODES
V %
MECHANICAL
.00 = ±.015 HOLE DIA. ±.005
.000 = ±.005 ANGLES ±1°
DIMENSIONS ARE IN INCHES.
KEEP FREE FROM SCRATCHES, BURRS AND TOOL MARKS.

SCALE —
DO NOT SCALE THIS DRAWING

DRW. BY Cheri DATE 12/15/67
CK. BY RM DATE 12/15/67
APP'D BY DATE 20 Dec 67

TITLE: SCHEMATIC, REF. OSCILLATOR

MODEL 796 DRW. NO. A-11-04979-

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